Appendix C, Noise Methodology

Charlotte Douglas International Airport

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Appendix C Noise Methodology

The following appendix describes the existing noise exposure on communities surrounding Charlotte Douglas International Airport (CLT or Airport). The noise analysis for this Part 150 Noise Compatibility Study (Part 150 Study) included the development of the noise contours for the existing conditions with a base year of 2023 and the future conditions with a year of 2028. Aircraft related noise exposure is defined through noise contours prepared using the Federal Aviation Administration's (FAA) Aviation Environmental Design Tool Version (AEDT) 3e per Title 14 Code of Federal Regulations (14 CFR) Part 150 guidelines. Inputs into the noise model include: the number of average-annual day aircraft operations (arrivals and departures) by aircraft type and time of day, the percent of time each runway end is used for arrival and departure, and flight paths to and from the runway ends.

An explanation of the AEDT and standard noise descriptors, along with a review of the physics of noise, research regarding noise impacts on humans, social impacts of noise, and the data required to develop noise contours are explained in the sections below.

C.1 Characteristics of Sound

Sound is created by a source that induces vibrations in the air. The vibration produces alternating bands of relatively dense and sparse particles of air, spreading outward from the source like ripples on a pond. Sound waves dissipate with increasing distance from the source. Sound waves can also be reflected, diffracted, refracted, or scattered. When the source stops vibrating, the sound waves disappear almost instantly and the sound ceases.

Sound conveys information to listeners. It can be instructional, alarming, pleasant, relaxing, or annoying. Identical sounds can be characterized by different people or even by the same person at different times, as desirable or unwanted. Unwanted sound is commonly referred to as "noise."

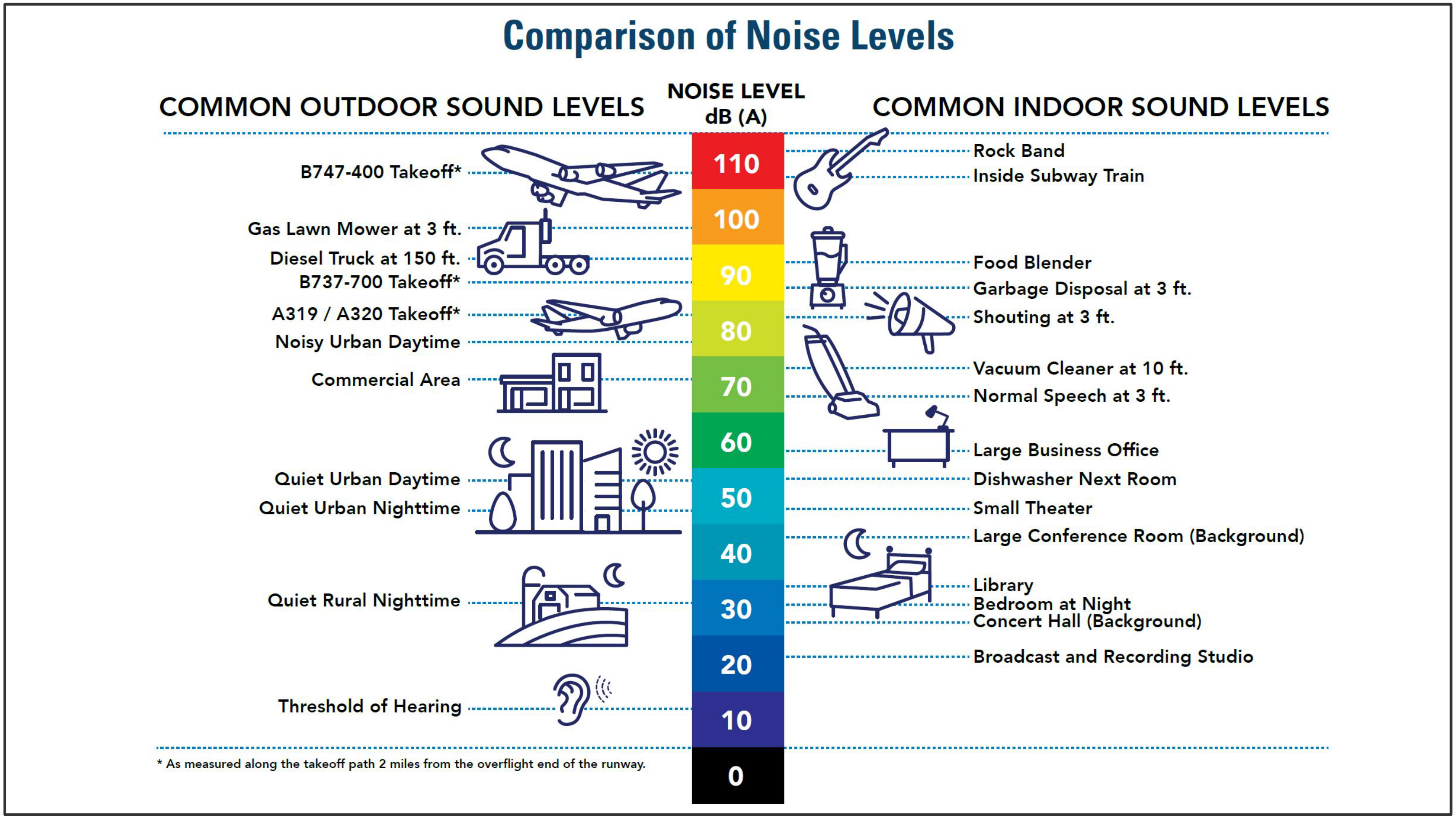
Sound can be defined in terms of three components:

- Level (amplitude)
- Pitch (frequency)
- Duration (time pattern)

C.1.1 Sound Level

The level or amplitude of sound is measured by the difference between atmospheric pressure (without the sound) and the total pressure (with the sound). Amplitude of sound is like the relative height of the ripples caused by the stone thrown into the water. Although physicists typically measure pressure using the linear Pascal scale, sound is measured using the logarithmic decibel (dB) scale. This is because the range of sound pressures detectable by the human ear can vary from *1 to 100 trillion units*. A logarithmic scale allows us to discuss and analyze noise using more manageable numbers. The range of audible sound ranges from approximately 1 to 140 dB, although everyday sounds rarely rise above about 120 dB. The human ear is extremely sensitive to sound pressure fluctuations. A sound of 140 dB, which is sharply painful to humans, contains *100 trillion (10^{14}) times more* sound pressure than the least audible sound. **Exhibit C-1, *Comparison of Sound***, shows a comparison of common sources of indoor and outdoor sounds measured on the dB scale.

Exhibit C-1 Comparison of Sound

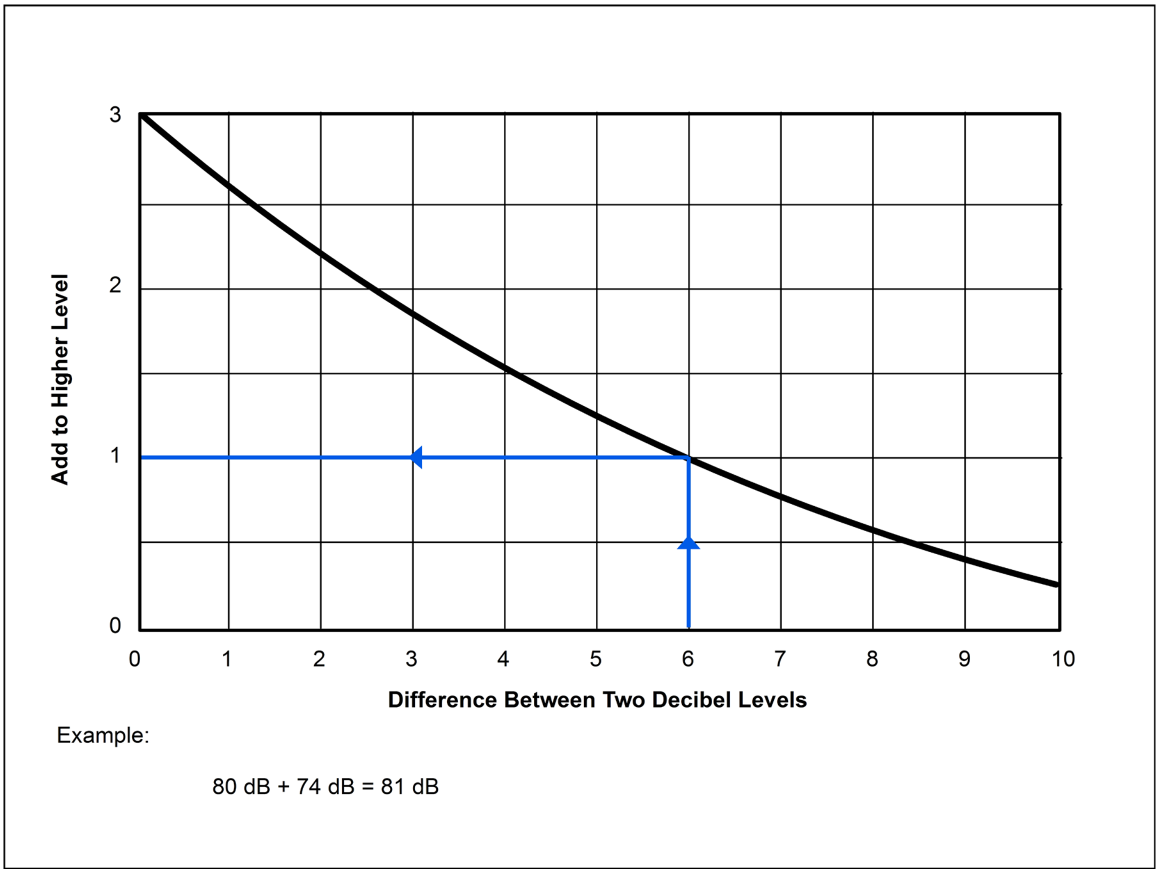


Source: Landrum & Brown, 2023.

By definition, a 10 dB increase in sound is equal to a tenfold (10^1) increase in the mean square sound pressure of the reference sound. A 20 dB increase is a 100-fold (10^2) increase in the mean square sound pressure of the reference sound. A 30 dB increase is a 1,000-fold (10^3) increase in mean square sound pressure.

A logarithmic scale requires different mathematics than used with linear scales. The sound pressures of two separate sounds, expressed in dB, are not arithmetically additive. For example, if a sound of 80 dB is added to another sound of 74 dB, the total is a 1 dB increase in the louder sound (81 dB), not the arithmetic sum of 154 dB (See **Exhibit C-2, *Example Addition of Two Decibels***). If two equally loud noise events occur simultaneously, the sound pressure level from the combined events is 3 dB higher than the level produced by either event alone.

Exhibit C-2 Example of Addition of Two Decibel Levels

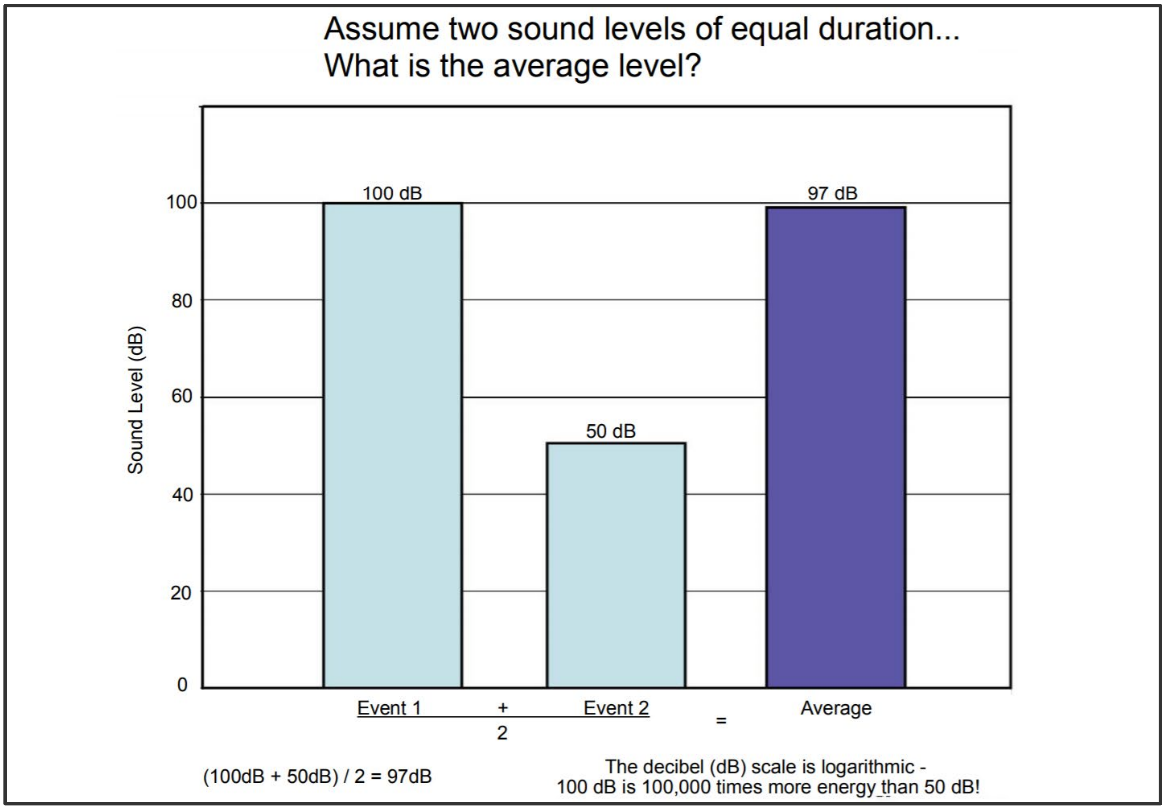


Source: Information on Levels of Environmental Noise, USEPA, March 1974

Logarithmic averaging also yields results that are quite different from simple arithmetic averaging. Consider the example shown in **Exhibit C-3, *Example of Sound Level Averaging***. Two sound levels of equal duration are averaged. One has a maximum sound level (Lmax) of 100 dB, the other 50 dB. Using conventional arithmetic, the average would be 75 dB. The true result, using logarithmic math, is 97 dB. This is because 100 dB has far more energy than 50 dB (100,000 times as much) and is overwhelmingly dominant in computing the average of the two sounds.

Human perceptions of changes in sound pressure are less sensitive than a sound level meter. People typically perceive a tenfold increase in sound pressure, a 10 dB increase, as a doubling of loudness. Conversely, a 10 dB decrease in sound pressure is normally perceived as half as loud. In community settings, most people perceive a 3 dB increase in sound pressure (a doubling of the sound pressure or energy) as just noticeable. (In laboratory settings, people with good hearing are able to detect changes in sounds of as little as 1 dB).

Exhibit C-3 Examples of Sound Level Averaging

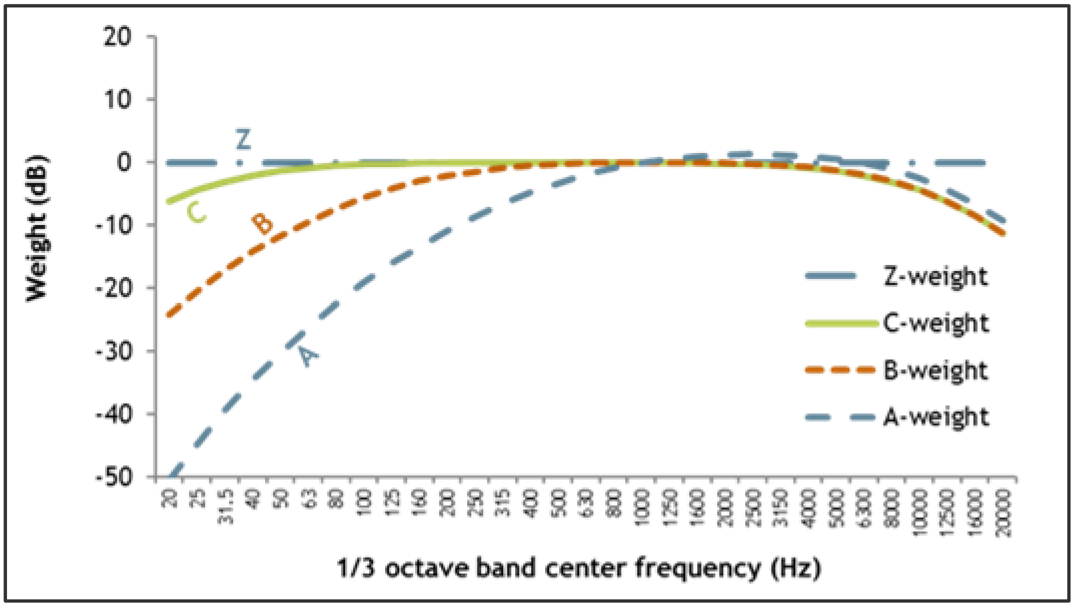


Source: Landrum & Brown, 2023.

The pitch (or frequency) of sound can vary greatly from a low-pitched rumble to a shrill whistle. If we consider the analogy of ripples in a pond, high frequency sounds are vibrations with tightly spaced ripples, while low rumbles are vibrations with widely spaced ripples. The rate at which a source vibrates determines the frequency. The rate of vibration is measured in units called “Hertz” -- the number of cycles, or waves, per second. One’s ability to hear a sound depends greatly on the frequency composition. Humans hear sounds best at frequencies between 1,000 and 6,000 Hertz. Sound at frequencies above 10,000 Hertz (high-pitched hissing) and below 100 Hertz (low rumble) are much more difficult to hear.

When attempting to measure sound in a way that approximates what our ears hear, we must give more weight to sounds at the frequencies we hear well and less weight to sounds at frequencies we do not hear well. Acousticians have developed several weighting scales for measuring sound. The A-weighted scale was developed to correlate with the judgments people make about the loudness of sounds. The A weighted decibel scale (dBA) is used in studies where audible sound is the focus of inquiry. **Exhibit C-4, *Sound Frequency Weighting Curves***, shows the A, B, and C sound weighting scale. The U.S. Environmental Protection Agency (USEPA) has recommended the use of the A-weighted decibel scale in studies of environmental noise.[1] Its use is required by the FAA in airport noise studies.[2] For the purposes of this analysis, dBA was used as the noise metric and dB and dBA are used interchangeably.

Exhibit C-4 Sound Frequency Weighting Curves



Source: Noise Measurement Handbook, Federal Highway Administration, 2018, Sec. 17.3.3.3.

C.1.2 Duration of Sounds

The duration of sounds – their patterns of loudness and pitch over time – can vary greatly. Sounds can be classified as continuous like a waterfall, impulsive like a firecracker, or intermittent like aircraft overflights. Intermittent sounds are produced for relatively short periods, with the instantaneous sound level during the event roughly appearing as a bell-shaped curve. An aircraft event is characterized by the period during which it rises above the background sound level, reaches its peak, and then recedes below the background level.

C.1.3 Perceived Noise Level

Perceived noisiness is another method of rating sound that was originally developed for the assessment of aircraft noise. Perceived noisiness is the subjective measure of the degree to which noise is unwanted or causes annoyance to an individual. To determine perceived noise level, individuals are asked to judge in a laboratory setting when two sounds are equally noisy or disturbing if heard regularly in their own environment. These surveys are inherently subjective and thus subject to greater variability. For example, two separate events of equal noise energy may be perceived differently if one sound is more annoying to the listener than the other.

C.1.4 Propagation of Noise

Outdoor sound levels decrease as a function of distance from the source, and as a result of wave divergence, atmospheric absorption, and ground attenuation. If sound is radiated from a source in an

1 Information on Levels of Environmental Noise Requisite to Protect Health and Welfare with an Adequate Margin of Safety. U.S. Environmental Protection Agency, Office of Noise Abatement and Control. 1974, P. A-10.
2 "Airport Noise Compatibility Planning." 14 CFR Part 150, Sec. A150.3.

homogeneous and undisturbed manner, the sound travels as spherical waves. As the sound wave travels away from the source, the sound energy is distributed over a greater area, dispersing the sound energy of the wave. Spherical spreading of the sound wave reduces the noise level at a rate of 6 dB per doubling of the distance.

Atmospheric absorption also influences the levels that are received by the observer. The greater the distance traveled, the greater the influence of the atmosphere and the resultant fluctuations. Atmospheric absorption becomes important at distances of greater than 1,000 feet. The degree of absorption is a function of the frequency of the sound as well as the humidity and temperature of the air. For example, atmospheric absorption is lowest at high humidity and higher temperatures. Sample atmospheric attenuation graphs are presented in **Exhibit C-5, *Sound Attenuation Graphs***. The graphs show noise absorption rates based on temperature, relative humidity, and distance at five different frequency ranges. For example, sounds at a frequency of 2,000 Hz, with a relative humidity of 10 percent and a temperature of 90° Fahrenheit (32° Celsius), will be dissipate by 10 dB per for every 1,000 feet (305 meters) from the source.

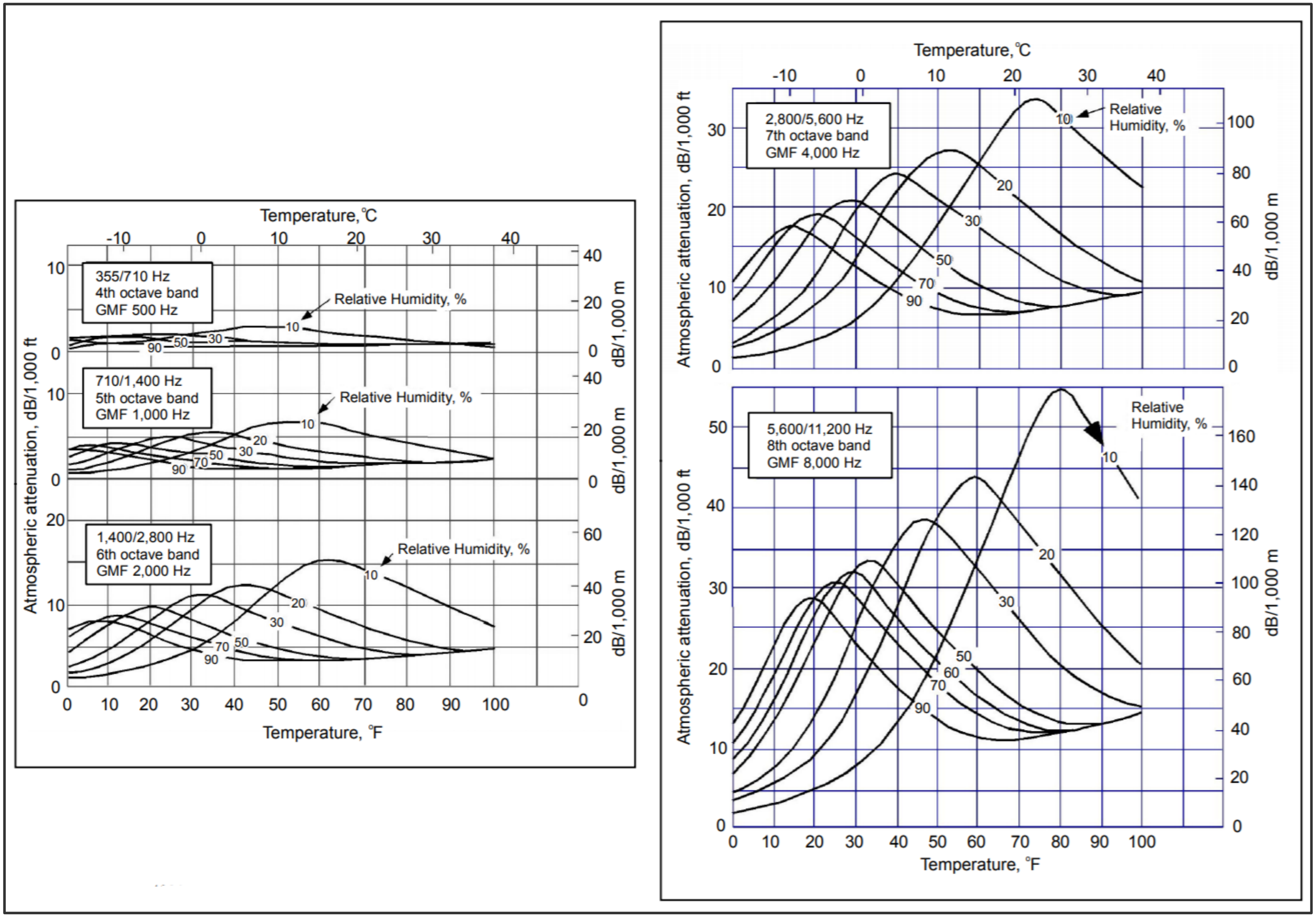
The rate of atmospheric absorption varies with sound frequency. The higher frequencies are more readily absorbed than the lower frequencies. Over large distances, the lower frequencies become the dominant sound as the higher frequencies are attenuated.

Turbulence and gradients of wind, temperature, and humidity also play a significant role in determining the degree of attenuation. Certain conditions, such as inversions, can also result in higher noise levels than would result from spherical spreading as a result of channeling or focusing the sound waves.

The effect of ground attenuation on noise propagation is a function of the height of the source and/or receiver and the characteristics of the terrain. The closer the source of noise is to the ground, the greater the ground absorption. Terrain consisting of soft surfaces such as vegetation provide for more ground absorption than hard surfaces. Ground attenuation is important for the study of noise from airfield operations (such as, thrust reversals) and in the design of noise berms or engine run-up facilities.

These factors are an important consideration for assessing in-flight and ground noise in the Charlotte area. Atmospheric conditions will play a significant role in affecting the sound levels on a daily basis and how these sounds are perceived by the population.

Exhibit C-5 Sound Attenuation Graphs



Source: Baraneck, 1981

C.2 Factors Influencing Human Response to Sound

Many factors influence how a sound is perceived and whether or not it is considered annoying to the listener. These factors include not only physical (acoustic) characteristics of the sound but also secondary (non-acoustic) factors, such as sociological and external factors.

Sound rating scales are developed to account for the factors that affect human response to sound. Nearly all of these factors are relevant in describing how sounds are perceived in the community. Many of the non-acoustic parameters play a prominent role in affecting individual response to noise. Background sound (ambient noise) is also important in describing sound in rural settings. Some non-acoustic factors that may influence an individual's response to aircraft noise include:

- Predictability of when the sound/noise will occur;
- How the noise affects certain activities;
- Fear of an aircraft crashing;
- Belief that aircraft noise could be prevented or reduced by aircraft designers, pilots, or authorities related to airlines or airports; and
- Sensitivity to noise in general.

Thus, it is important to recognize that non-acoustic factors such as those described above, as well as acoustic factors, contribute to human response to noise.

C.3 Standard Noise Descriptors

Given the multiple dimensions of sound, a variety of descriptors, or metrics, have been developed for describing sound and noise. Some of the most commonly used metrics are discussed in this section.

C.3.1 Maximum Level

Maximum level (Lmax) is simply the highest sound level, or peak level, recorded during an event or over a given period of time. It provides a simple and understandable way to describe a sound event and compare it with other events. In addition to describing the peak sound level, the Lmax can be reported on an appropriate weighted decibel scale (A-weighted, for example) so that it can disclose information about the frequency range of the sound event in addition to the loudness.

The Lmax, however, fails to provide any information about the duration of the sound event. This can be a critical shortcoming when comparing different sounds. Even if they have identical Lmax values, sounds of greater duration contain more sound energy than sounds of shorter duration. Research has demonstrated that for many kinds of sound effects, the total sound energy, not just the peak sound level, is a critical consideration.

C.3.2 Time Above Level

The time above level (TA) metric indicates the amount of time that sound at a particular location exceeds a given sound level threshold. The TA is often expressed in terms of the total time per day that the threshold is exceeded. The TA metric explicitly provides information about the duration of sound events, although it conveys no information about the peak levels during the period of observation.

C.3.3 Number of Events Above Level

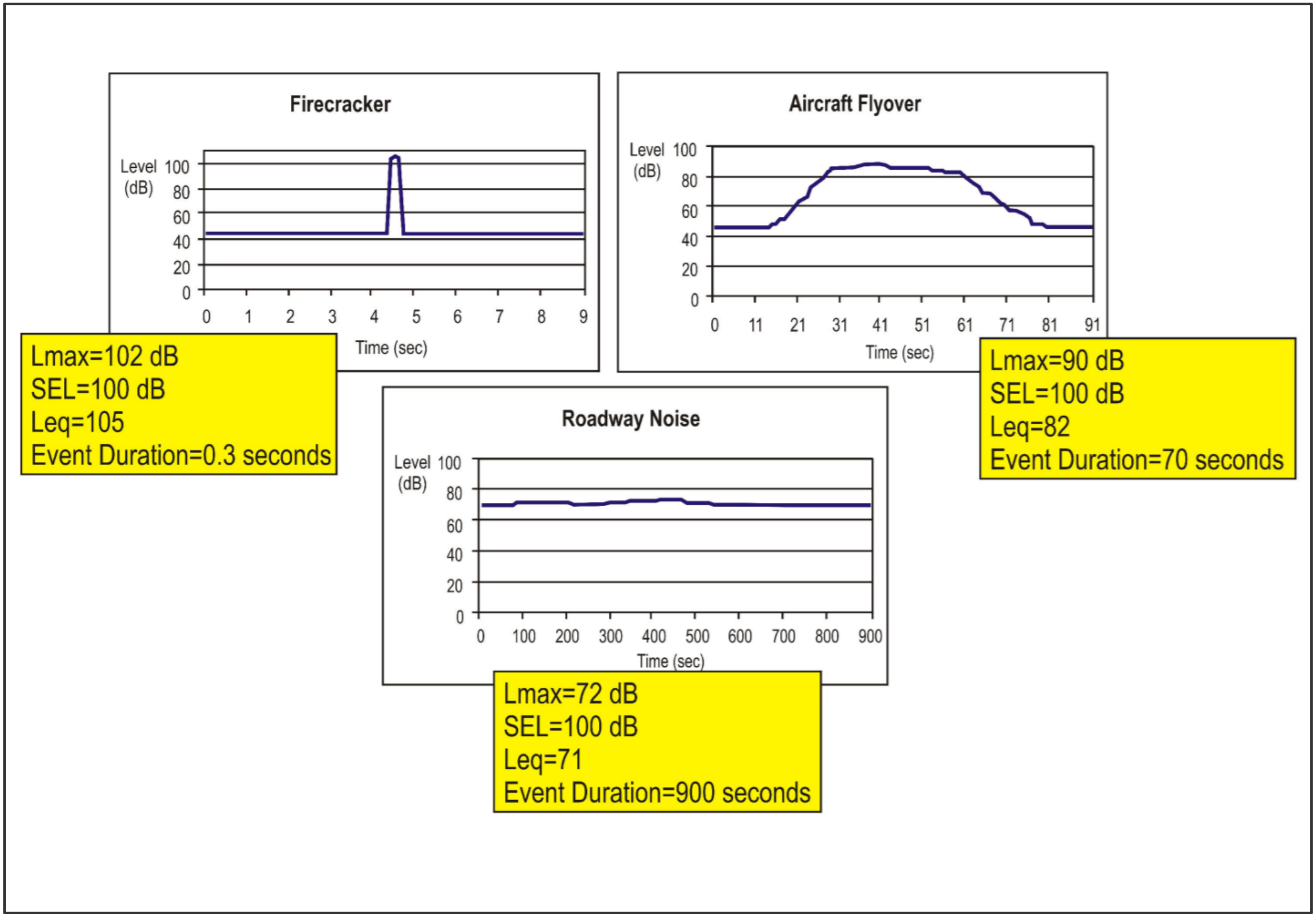
Similar to the TA, the number of events above (NA) metric indicates the total number of aircraft events at particular location that exceed a given sound level threshold in dB. The NA metric explicitly provides information about the number of sound events, although it conveys no information about the duration of the event(s).

C.3.4 Sound Exposure Level

The sound exposure level (SEL) metric provides a way of describing the total sound energy of a single event. In computing the SEL value, all sound energy occurring during the event, within 10 dB of the Lmax, is mathematically integrated over one second. (Very little information is lost by discarding the sound below the 10 dB cut-off, since the highest sound levels completely dominate the integration calculation.) Consequently, the SEL is always greater than the Lmax for events with a duration greater than one second. SELs for aircraft overflights typically range from five to 10 dB higher than the Lmax for the event.

Exhibit C-6, *Measurement of Different Types of Sound*, shows graphs of instantaneous sound levels for three different events: an aircraft flyover, steady roadway noise, and a firecracker. The Lmax and the duration of each event differ greatly. The pop of the firecracker is quite loud, 102 dB but lasts less than a second. The aircraft flyover has a considerably lower Lmax at 90 dB, but the event lasts for over a minute. The Lmax from the roadway noise is even quieter at only 72 dB, but it lasts for 15 minutes. By considering the loudness and the duration of these very different events simultaneously, the SEL metric reveals that the total sound energy of all three is identical. This can be a critical finding for studies where total noise dosage is the focus of study. As it happens, research has shown conclusively that noise dosage is crucial in understanding the effects of noise on animals and humans.

Exhibit C-6 **Measurement of Different Types of Sound**



Source: Landrum & Brown, 2023.

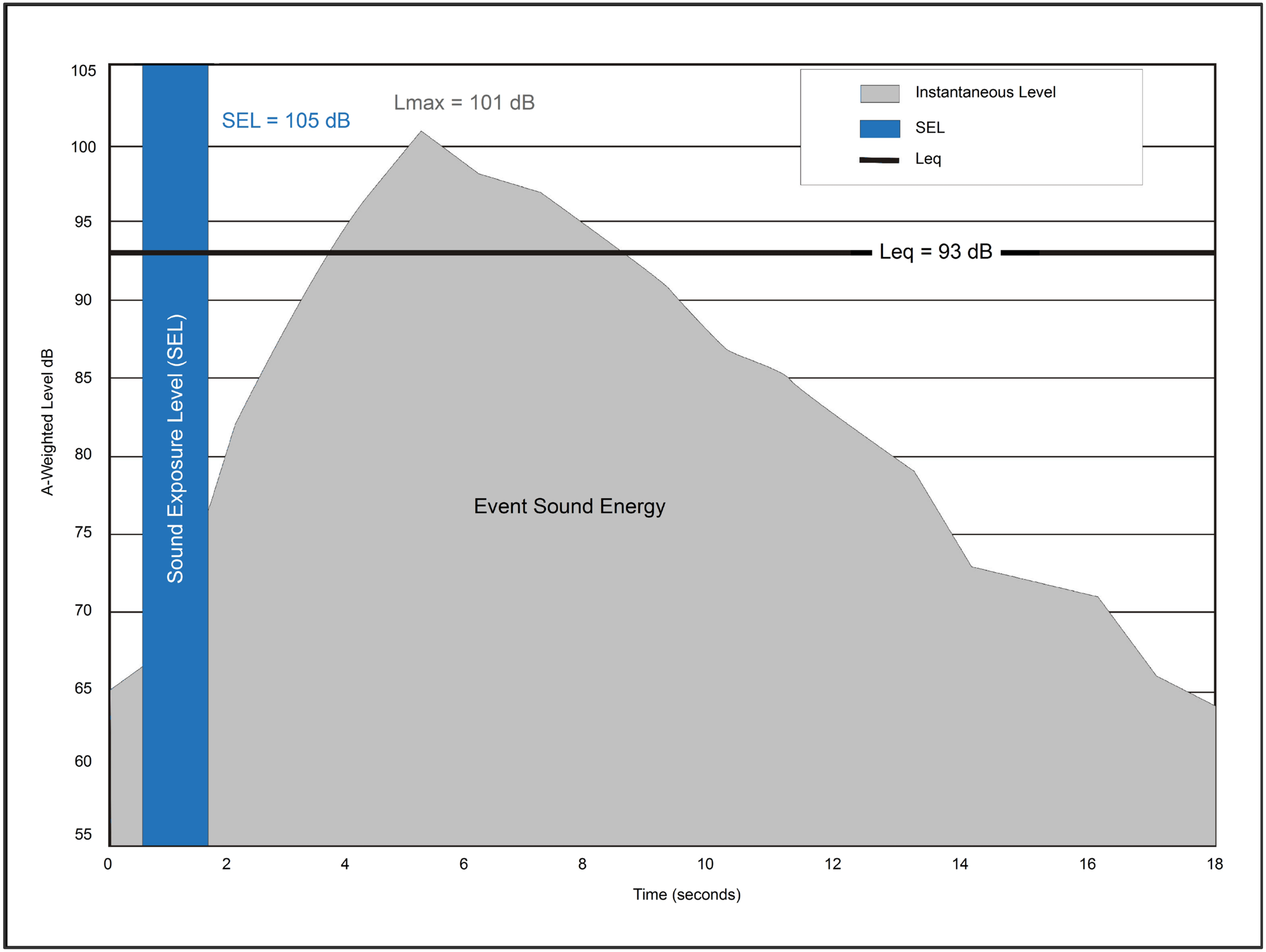
C.3.5 Equivalent Sound Level

The equivalent sound level (Leq) metric may be used to define cumulative noise dosage, or noise exposure, over a period of time. In computing Leq, the total noise energy over a given period of time, during which numerous events may have occurred, is logarithmically averaged over the time period. The Leq represents the steady sound level that is equivalent to the varying sound levels actually occurring during the period of observation. For example, an 8-hour Leq of 67 dB indicates that the amount of sound energy in all the peaks and valleys that occurred in the 8 hour period is equivalent to the energy in a continuous sound level of 67 dB. Leq is typically computed for measurement periods of 1 hour, 8 hours, or 24 hours, although any time period can be specified.

Exhibit C-7, *Relationship Among Sound Metrics*, shows the relationship of Leq to Lmax and SEL. In this example, a single aircraft event lasting 18 seconds is represented. The instantaneous noise levels for the event range from 64 to an Lmax of 101 dBA. The area under the curve represents the sound energy accumulated during the entire event. The compression of this energy into a single second results in an SEL of 105 dBA. The Leq average of the sound energy for each second during the event would be 93 dB. If this event were the only event to occur during an hour, the aircraft sound energy for the other 3,582 seconds would be considered to be zero. When converted to an hourly LEQ, the level would be nearly 70 dB of Leq. This again indicates the dominance of loud events in noise summation and averaging computations.

The Leq is a critical noise metric for many kinds of analysis where total noise dosage, or noise exposure, is under investigation. As already noted, noise dosage is important in understanding the effects of noise on both animals and people. Indeed, research has led to the formulation of the “equal energy rule.” This rule states that it is the total acoustical energy to which people are exposed that explains the effects the noise will have on them. That is, a very loud noise with a short duration will have the same effect as a lesser noise with a longer duration if they have the same total sound energy.

Exhibit C-7 Relationship Among Sound Metrics



Source: Landrum & Brown, 2023.

C.3.6 Day-Night Average Sound Level

The day-night average sound level (DNL) metric is really a variation of the 24 hour Leq metric. Like Leq, the DNL metric describes the total noise exposure during a given period. Unlike Leq, however, DNL, by definition, can only be applied to a 24-hour period. In computing DNL, an extra weight of 10 dB is assigned to any sound levels occurring between the hours of 10:00 p.m. and 7:00 a.m. This is intended to account for the greater annoyance that nighttime noise is presumed to cause for most people. Recalling the logarithmic nature of the dB scale, this extra weight treats one nighttime noise event as equivalent to 10 daytime events of the same magnitude.

As with Leq, DNL values are strongly influenced by the loud events. For example, 30 seconds of sound of 100 dB, followed by 23 hours, 59 minutes, and 30 seconds of silence would compute to a DNL value of 65 dB. If the 30 seconds occurred at night, it would yield a DNL of 75 dB.

This example can be roughly equated to an airport noise environment. Recall that an SEL is the mathematical compression of a noise event into one second. Thus, 30 SELs of 100 dB during a 24-hour period would equal DNL 65 dB, or DNL 75 dB if they occurred at night. This situation could actually occur in places around a real airport. If the area experienced 30 overflights during the day, each of which produced an SEL of 100 dB, it would be exposed to DNL 65 dB. Recalling the relationship of SEL to the Lmax of an aircraft overflight, the Lmax recorded for each of those overflights (the peak level a person would actually hear) would typically range from 90 to 95 dB.

C.4 Health Effects of Noise

A considerable amount of research has been conducted to identify, measure, and quantify the potential effects of aviation noise on health. The various methods by which noise can be measured (e.g. single dose, long-term average, number of events above a certain level, etc.), and difficulties in separating other lifestyle factors from the analysis, increases the complexity of determining the health effects of noise, and has caused considerable variability in the results of past studies. The health effects of noise are often divided into the following topics: cardiovascular effects, hearing loss, sleep disturbance, and speech/communication interference.

C.4.1 Cardiovascular Effects

Several studies have suggested that increased hypertension or other cardiovascular effects, such as increased blood pressure, and change in pulse rate, may be associated with long-term exposure to high levels of environmental noise. When conducting cross-sectional studies of environmental noise exposure, it is difficult to control for other important variables. Subsequent reviews of past research have pointed out that such studies "…are notoriously difficult to interpret. They often report conflicting results, generally do not identify a cause and effect relationship, and often do not report a dose-response relationship between the cause and effect."[3] In 2018, the World Health Organization (WHO) published its Environmental Noise Guidelines report (WHO report) with reference to recent research related to aircraft noise and human response.[4] The WHO report references two ecological studies that provide information on the relationship between aircraft noise and incidence of ischemic heart disease (IHD); however, this "…evidence was rated low quality." Additionally, the WHO report reference one cohort study and several cross-sectional studies of the relationship between aircraft noise and hypertension. The WHO report noted "…inconsistency across studies" and the "…evidence was rated low quality." Similar studies of the

3 Airport Cooperative Research Program, Transportation Research Board, Effects of Aircraft Noise: Research Update on Selected Topics, 2008.
4 World Health Organization, Regional Office for Europe, Environmental Noise Guidelines for the European Region, 2018.

relationship between aircraft noise and cases of stroke were reviewed. The WHO report noted that this "…evidence was rated very low quality." Therefore, it is difficult to draw any conclusions about the relationship between aircraft noise exposure and cardiovascular effects.

C.4.2 Hearing Loss

The potential for noise-induced hearing loss is commonly associated with occupational noise exposure from working in a noisy work environment or recreational noise such as listening to loud music. Recent studies have concluded that "because environmental noise does not approximate occupational noise levels or recreational noise exposures…it does not have an effect on hearing threshold levels." Furthermore, "aviation noise does not pose a risk factor for child or adolescent hearing loss, but perhaps other noise sources (personal music devices, concerts, motorcycles, or night clubs) are a main risk factor."[5] This conclusion is supported by the 2018 WHO Environmental Noise Guidelines which notes that "no studies were found, and therefore no evidence was available on the association between aircraft noise and hearing impairment and tinnitus."[6] Because aviation noise levels near airports do not approach levels of occupational or recreational noise exposures associated with hearing loss, hearing impairment is likely not caused by aircraft noise for populations living near an airport.

C.4.3 Sleep Disturbance

Sleep disturbance is a common complaint from people who live in the vicinity of an airport. A large amount of research has been published on the topic of sleep disturbance caused by environmental noise. This research has produced variable results due to differing definitions of sleep disturbance, different ways for measuring sleep disturbance (behavioral awakenings or sleep interruption), and different settings in which to measure it (laboratory setting or field setting).

In 1992, the Federal Interagency Committee on Noise (FICON) recommended an interim dose-response curve to predict the percent of the exposed population expected to be awakened (percent awakening) as a function of the exposure to single event noise levels expressed in terms of the SEL. This interim curve was based on statistical adjustment of previous analysis and included data from both laboratory and field studies. In 1997, Federal Interagency Committee on Aviation Noise (FICAN) recommended a revised sleep disturbance relationship based on data and analysis from three field studies.

Exhibit C-8, *Sleep Disturbance Dose-Response Curves*, show the results of the 1992 and 1997 analyses. The top graph shows a comparison of the 1992 FICON and 1997 FICAN curves. The 1997 FICAN curve represents the upper limit of the observed field data and should be interpreted as predicting the "maximum percent of the exposed population expected to be behaviorally awakened", or the "maximum percent awakened" for a given residential population.

In 2008, FICAN recommended the use of a revised method to predict sleep disturbance in terms of percent awakenings based on data published by the American National Standards Institute (ANSI).[7] In contrast to the earlier FICAN recommendation, the 2008 ANSI standard indicates that the probability of awakening is lower for a single noise event in cases where the population is exposed to the given noise source for a long period of time (more than one year) compared to the probability of awakening for sound that is new to an area. In Exhibit C-8, the lower graph shows these two relationships, with Equation 1 (blue dotted line) representing percent awakenings from long-term noise and Equation B1 (pink dashed line) representing percent awakenings from a new noise source based on the 1997 FICAN results. As

[5] Airport Cooperative Research Program, Transportation Research Board, Effects of Aircraft Noise: Research Update on Selected Topics, 2008.
[6] World Health Organization, Regional Office for Europe, Environmental Noise Guidelines for the European Region, 2018.
[7] ANSI S12.9-2008, Quantities and Procedures for Description and Measurement of Environmental Sound — Part 6: Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes, 2008.

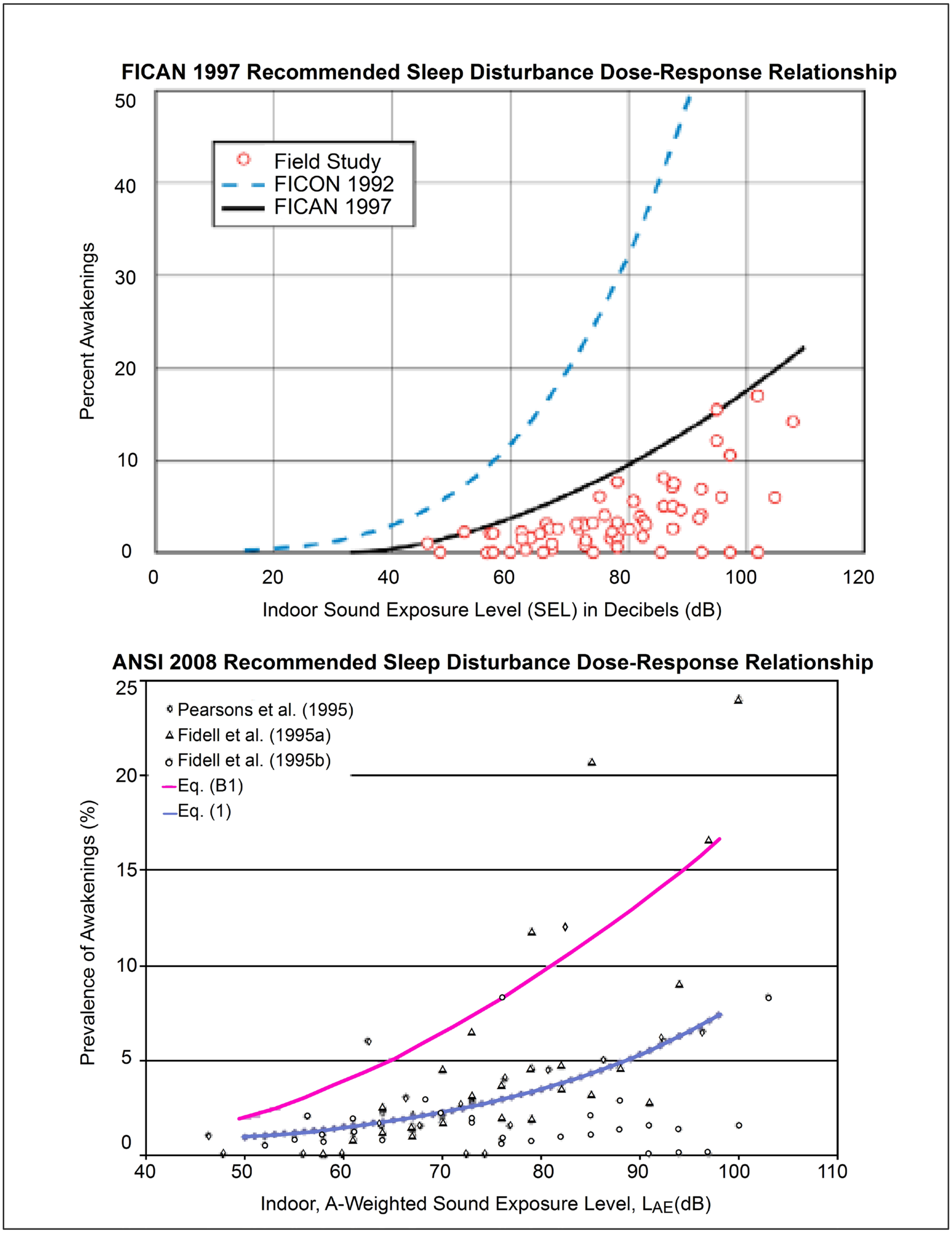
shown in this exhibit, at an indoor SEL of 100 dB, the probability of awakenings would be expected to exceed 15 percent for a new noise source; yet for long-term noise sources, the probability of awakening is expected to be less than 10 percent.

The numerous studies and reports that have been developed on the subject of sleep disturbance related to environmental noise over the past several decades have produced varied results. A review of past studies conducted by the Airport Cooperative Research Program (ACRP) suggests that in-home sleep disturbance studies clearly demonstrate that it requires more noise to cause awakenings than was previously theorized based on laboratory sleep disturbance studies.[8] The 2018 WHO Environmental Noise Guidelines references six studies that attempted to measure sleep disturbance at noise levels between 40 dB and 65 dB. Over 11% of the population was characterized as highly sleep-disturbed at nighttime levels of 40 dB. These studies were based on self-reporting and the "…evidence was rated moderate quality…" for an association between aircraft noise and probability of awakenings.[9]

Due to the variability of study methodologies, particularly studies outside of a laboratory, and other influencing factors, it is difficult to determine the noise level at which a high percentage of the population would be expected to be awakened by aircraft noise. No definitive conclusions have been drawn on the percent of a population that is estimated to be awakened by a certain level of aircraft noise and recent studies have cautioned about the over interpretation of the data.[10]

8 Airport Cooperative Research Program, Transportation Research Board, Effects of Aircraft Noise: Research Update on Selected Topics, 2008.
9 World Health Organization, Regional Office for Europe, Environmental Noise Guidelines for the European Region, 2018.
10 Airport Cooperative Research Program, Transportation Research Board, Effects of Aircraft Noise: Research Update on Selected Topics, 2008.

Exhibit C-8 Sleep Disturbance Dose-Response Curve



Source: FICAN, June 1997; American National standards Institute, 2008.

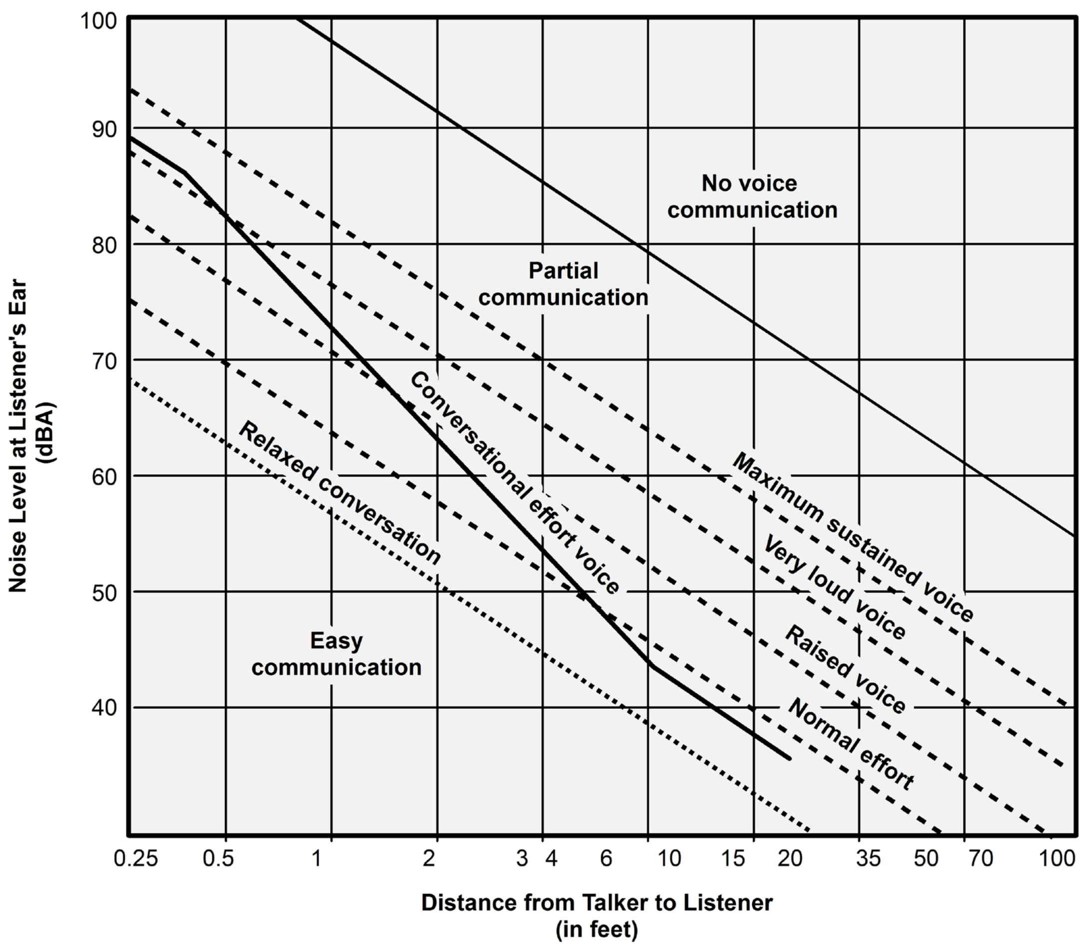
C.4.4 Communication Interference

Communication interference can impact activities such as personal conversations, classroom learning, and listening to radio and television. Most studies have focused on communication interference due to continual noise sources. In 1974, the USEPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, which is one of the few studies to focus on intermittent noise. The study concluded that for voice communication, an indoor Leq of 45 dB allows normal conversation at distances up to 2 meters with 95 percent sentence intelligibility. **Exhibit C-9, *Noise Effects on Distance Necessary for Speech Communication***, shows the required distance between talker and listener based on the type of speech communication (normal voice, loud voice, etc.) and the environmental noise level from the 1974 USEPA report.

Noise can also impact communication between student and teacher necessary for learning in a classroom setting. It is usually accepted that noise levels above a certain Leq may affect a child's learning experiences. Research has shown a "decline in reading when outdoor noise levels equal or exceed Leq of 65 dBA."[11] Furthermore, a study conducted by FICAN in 2007 found: "(1) a substantial association between noise reduction and decreased failure (worst-score) rates for high-school students, and (2) significant association between noise reduction and increased average test scores for student/test subgroups. In general, the study found little dependence upon student group and upon test type."[12] A study of noise exposure and the effects on school test scores between 2000/01 and 2008/09 found "…statistically significant associations between airport noise and student mathematics and reading test scores, after taking demographic and school factors into account."[13] This study also found that schools that had been provided sound insulation had better test scores than schools that were not sound insulated. This Study made no recommendation regarding the noise level at which impacts upon learning may occur.

11 Airport Cooperative Research Program, Transportation Research Board, Effects of Aircraft Noise: Research Update on Selected Topics, 2008.
12 Federal Interagency Committee on Aviation Noise (FICAN), Findings of the FICAN Pilot Study on the Relationship between Aircraft Noise Reduction and Changes in Standardized Test Scores, July 2007.
13 National Academies of Sciences, Engineering, and Medicine; Assessing Aircraft Noise Conditions Affecting Student Learning, Volume 1: Final Report; 2014.

Exhibit C-9 Noise Effects on Distance Necessary for Speech Communication



Source: FICON, 1992; from USEPA, 1974.

C.5 Existing (2023) Baseline Noise Exposure Contour

The following sections summarizes the noise modeling methodology and data inputs for the Existing (2023) Baseline noise contour modeling for this Part 150 Noise Compatibility Study Update (Study) for CLT. Data inputs developed include runway definition, number of aircraft operations during the time period evaluated, the types of aircraft flown, the time of day when they are flown, how frequently each runway is used for arriving and departing aircraft, the routes of flight used when arriving to and departing from the runways, helicopter operations, and ground run-up activity. The FAA AEDT version 3e was used to calculate noise exposure for the area around the Airport and outputs contours of equal noise exposure using the DNL metric.[14] The following describes the inputs developed for the Existing (2023) Baseline conditions.

C.5.1 Runway Definition

The Airport currently has three parallel runways (18L/36R, 18C/36C, and 18R/36L). This runway configuration would remain under the Existing (2023) Baseline.[15] The airfield layout for the Existing (2023) Baseline at CLT is shown on **Exhibit C-10, *Airport Layout Plan – Existing (2023) Baseline.*** The runways and lengths at CLT for the Existing (2023) Baseline are listed below:

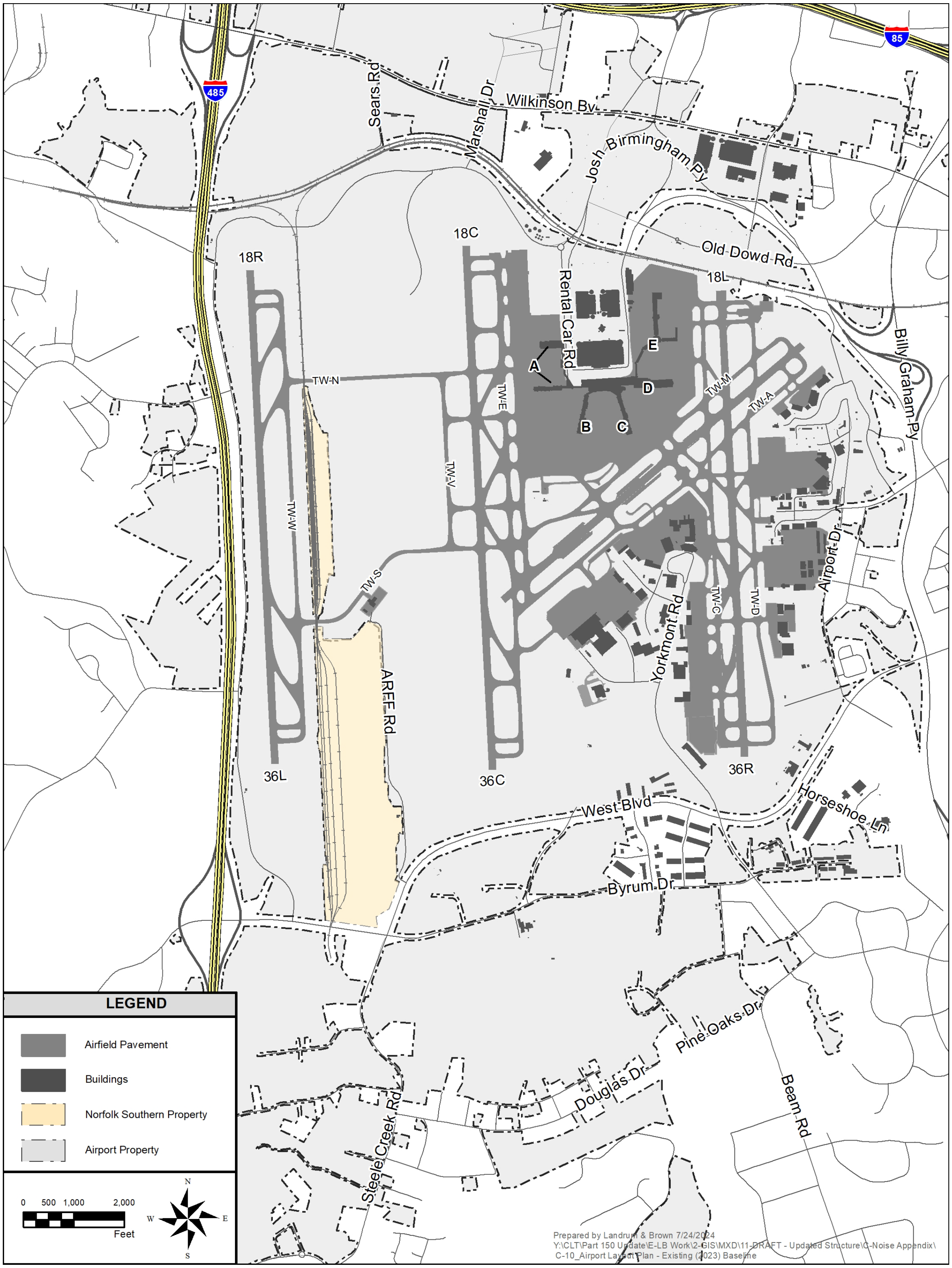
Runway	Length (feet)
18L/36R	8,676
18C/36C	10,000
18R/36L	9,000

C.5.2 Number of Operations and Fleet Mix

The number of annual operations modeled for the Existing (2023) Baseline was developed based on a review of FAA's Operations Network (OPSNET) data for April 2021 through March 2022. The data included 526,454 total annual operations, or 1,442.3 average-annual day operations. Specific aircraft types and times of operation for commercial aircraft were developed from CLT Landing Reports and CLT Flight Tracking System data. **Table C-1, *Distribution Of Average Daily Operations By Aircraft Type - Existing (2023) Baseline*** shows the number of aircraft operations by aircraft type during the daytime (7:00 a.m. – 9:59 p.m.) and nighttime (10:00 p.m. – 6:59 a.m.) for the Existing (2023) Baseline scenario.

[14] AEDT Version 3e was the most recent version of AEDT when the noise modeling began.
[15] Runway 05/23 was decommissioned in 2022 and is not used for the purpose of this analysis

Exhibit C-10 Airport Layout Plan – Existing (2023) Baseline



Source: Landrum & Brown, 2022

Table C-1 Distribution of Average Daily Operations by Aircraft Type - Existing (2023) Baseline

AEDT Airframe Type	AEDT Engine Code	Arrivals		Departures		Total
		Daytime	Nighttime	Daytime	Nighttime	
Heavy Passenger Jets						
Airbus A350-900 series	01P18RR124	0.3	0.0	0.4	0.0	0.7
Boeing 777-200-ER	2RR027	3.7	0.1	3.7	0.1	7.6
Subtotal		*4.0*	*0.1*	*4.1*	*0.1*	*8.3*
Cargo Jet						
Airbus A300F4-600 Series	1PW048	0.3	0.2	0.3	0.2	1.0
Airbus A300F4-600 Series	2GE039	0.8	0.4	0.7	0.4	2.3
Boeing 757-200 Series Freighter	3RR028	0.3	0.2	0.5	0.1	1.1
Boeing 757-200 Series Freighter	4PW073	0.5	0.4	0.7	0.2	1.8
Boeing 767-200 Series Freighter	1GE012	0.8	0.1	0.0	0.9	1.8
Boeing 767-300 ER Freighter	1GE030	1.2	0.4	0.7	1.0	3.3
Boeing 767-300 ER Freighter	2GE054	0.5	0.2	0.3	0.4	1.4
Boeing MD-11 Freighter	1GE031	0.1	0.7	0.6	0.0	1.4
Subtotal		*4.5*	*2.6*	*3.8*	*3.2*	*14.1*
Large Passenger Jet						
Airbus A319-100 Series	2CM019	31.4	1.5	28.8	4.1	65.8
Airbus A319-100 Series	3IA006	0.2	0.0	0.3	0.0	0.5
Airbus A319-100 Series	3IA007	23.9	1	21.9	3.1	49.9
Airbus A319-100 Series	4CM036	1.5	0.1	1.3	0.2	3.1
Airbus A320-200 Series	1IA003	14.9	1.1	14.1	1.9	32.0
Airbus A320-200 Series	2CM014	17.3	1.2	16.3	2.2	37.0
Airbus A320-200 Series	8IA010	0.3	0.0	0.2	0.0	0.5
Airbus A320-NEO	01P20CM128	2.0	0.8	2.5	0.2	5.5
Airbus A321-200 Series	01P08CM104	24.1	2.7	24.2	2.7	53.7
Airbus A321-200 Series	3IA008	62.1	7.2	62.4	6.9	138.6
Boeing 717-200 Series	4BR005	9.6	2.2	10	2.0	23.8
Boeing 737-700 Series	3CM031	3.0	0.6	3.3	0.3	7.2
Boeing 737-700 Series	3CM032	0.6	0.1	0.6	0.1	1.4
Boeing 737-8	01P20CM135	0.5	0.1	0.5	0.1	1.2
Boeing 737-8	01P20CM140	0.4	0.1	0.5	0.0	1.0
Boeing 737-800 Series	3CM032	43.1	3.3	41.3	5.1	92.8
Boeing 737-800 Series	3CM034	3.1	0.3	3.0	0.4	6.8
Boeing 737-800 Series	8CM051	44.5	3.5	42.7	5.2	95.9
Boeing 737-900-ER	8CM051	0.1	0.0	0.2	0.0	0.3
Bombardier CRJ-700	01P08GE192	1.9	0.1	1.8	0.2	4.0
Bombardier CRJ-700-ER	5GE083	71.7	5.6	69.1	8.2	154.6
Bombardier CRJ-900	01P08GE190	3.2	0.2	2.9	0.4	6.7
Bombardier CRJ-900-ER	01P08GE190	133.0	8.5	125.8	15.7	283.0
Embraer ERJ170	01P08GE197	8.8	0.4	8.3	0.8	18.3
Embraer ERJ170-LR	01P08GE197	7.0	0.2	6.6	0.7	14.5
Embraer ERJ175-LR	01P08GE197	34.0	5.4	34.6	4.9	78.9
Embraer ERJ190-AR	10GE131	1.3	0.1	1.3	0.0	2.7
Subtotal		*543.5*	*46.3*	*524.5*	*65.4*	*1,179.7*
Regional Jet						
Embraer ERJ135	6AL012	1.9	0.0	1.9	0.0	3.8
Embraer ERJ145-LR	6AL005	60.7	5.2	59.0	7.0	131.9
Subtotal		*62.6*	*5.2*	*60.9*	*7.0*	*135.7*

Table C-1 Distribution of Average Daily Operations by Aircraft Type – Existing (2023) Baseline *(Continued)*

AEDT Airframe Type	AEDT Engine Code	Arrivals		Departures		Total
		Daytime	Nighttime	Daytime	Nighttime	
Commuter / Cargo Prop						
Cessna 172 Skyhawk	IO360	0.6	0.1	0.6	0.2	1.5
Pilatus PC-12	PT6A67	3.2	0.2	3.2	0.2	6.8
Piper PA-32 Cherokee Six	TIO540	0.3	0.0	0.3	0.0	0.6
Raytheon Super King Air 300	PT6A60	3.0	0.1	2.9	0.2	6.2
Subtotal		*7.1*	*0.4*	*7.0*	*0.6*	*15.1*
General Aviation Regional Jet						
Bombardier Challenger 300	11HN003	4.2	0.3	4.2	0.2	8.9
Bombardier Challenger 600	01P05GE189	0.8	0	0.8	0.1	1.7
Bombardier Challenger 600	1TL001	0.3	0	0.4	0	0.7
Bombardier Global Express	01P04BR013	0.3	0	0.3	0	0.6
Bombardier Learjet 45	1AS001	0.4	0	0.4	0	0.8
Cessna 550 Citation II	1PW036	0.4	0	0.4	0.2	1
Cessna 560 Citation Excel	PW530	3.2	0.2	3.2	0.1	6.7
Cessna 560 Citation V	1PW037	1.8	0.6	2.1	0.3	4.8
Cessna 560 Citation XLS	PW530	1.1	0	1	0.1	2.2
Cessna 650 Citation III	1AS001	0.3	0	0.4	0	0.7
Cessna 680 Citation Sovereign	03P14PW194	0.9	0	0.9	0.1	1.9
Cessna 680 Citation Sovereign	7PW078	0.5	0	0.6	0.1	1.2
Cessna 680-A Citation Latitude	7PW078	5.7	0.4	5.6	0.3	12
Cessna 750 Citation X	6AL022	0.8	0	0.7	0.1	1.6
Cessna CitationJet CJ/CJ1 (Cessna 525)	1PW035	1.3	0.1	1.4	0.1	2.9
Cessna CitationJet CJ2 (Cessna 525A)	1PW036	0.9	0.1	0.8	0.1	1.9
Cessna CitationJet CJ3 (Cessna 525B)	1PW038	1.3	0.1	1.3	0	2.7
Dassault Falcon 2000	03P14PW194	2.2	0.2	2.1	0.1	4.6
Dassault Falcon 50	1AS002	0.3	0	0.4	0	0.7
Dassault Falcon 900	1AS002	2.1	0.1	2.1	0.1	4.4
Dassault Falcon 900-EX	1AS002	0.9	0.1	0.8	0.1	1.9
Embraer Phenom 100 (EMB-500)	PW530	0.4	0	0.4	0	0.8
Embraer Phenom 300 (EMB-505)	PW530	2.3	0.1	2.3	0.1	4.8
Gulfstream G280	01P11HN012	1.3	0.1	1.4	0.1	2.9
Gulfstream G400	11RR048	0.9	0.1	0.9	0.1	2
Gulfstream G-5 Gulfstream 5 / G-5SP Gulfstream G500	3BR001	0.6	0.1	0.5	0	1.2
Gulfstream G650	01P11BR016	0.6	0.1	0.6	0.1	1.4
Raytheon Beechjet 400	1PW038	1.7	0.1	1.6	0.1	3.5
Raytheon Hawker 800	1AS002	1	0	0.9	0	1.9
Raytheon Premier I	1PW036	0.4	0	0.4	0	0.8
Subtotal		*38.9*	*2.8*	*38.9*	*2.6*	*83.2*
Helicopters						
Agusta A119	250B17	0.2	0.0	0.2	0.0	0.4
Bell 407 / Rolls-Royce 250-C47B	250B17	0.2	0.0	0.1	0.1	0.4
Eurocopter EC-130	TPE3	0.8	0.3	0.7	0.3	2.1
Subtotal		*1.2*	*0.3*	*1.0*	*0.4*	*2.9*

Table C-1 Distribution of Average Daily Operations by Aircraft Type – Existing (2023) Baseline (Continued)

AEDT Airframe Type	AEDT Engine Code	Arrivals		Departures		Total
		Daytime	Nighttime	Daytime	Nighttime	
Military						
Boeing C17A	F1171	1.6	0.0	1.7	0.0	3.3
Subtotal		*1.6*	*0.0*	*1.7*	*0.0*	*3.3*
Grand Total		**663.4**	**57.7**	**641.9**	**79.3**	**1,442.3**

Notes: Day = 7:00 a.m. to 9:59 p.m., Night = 10:00 p.m. to 6:59 a.m.
Totals may not equal sum due to rounding.
Source: Landing Fee Reports, FAA Operations Network (OPSNET) data, CLT Flight Tracking System Data, Landrum & Brown, 2022.

C.5.3 Runway End Utilization

CLT is operated in one of two primary runway configurations, north flow or south flow. When in north flow, aircraft arrive to CLT from the south in a north direction to land on Runway 36R, Runway 36C, and Runway 36L; and depart heading north from Runway 36R and Runway 36C. When in south flow, aircraft arrive to CLT from the north in a south direction to land on Runway 18L, Runway 18C, and Runway 18R; and depart heading south from Runway 18L and Runway 18C. The runway configuration is primarily dictated by wind direction and airfield efficiency. A review of runway use data derived from the CLT Flight Tracking System for April 2021 through March 2022 shows that CLT operated in north flow approximately 56 percent of the time and south flow approximately 44 percent of the time.

The distribution of landings and take-offs from each runway is determined by FAA airport traffic controllers to maintain airfield and airspace efficiency. Runway use percentages were derived for aircraft types and summarized by category. **Table C-2, *Average Annual Day Runway Use – Existing (2023) Baseline*** summarizes the percentage of use by each aircraft category on each of the runways at CLT during the daytime (7:00 a.m. – 9:59 p.m.) and nighttime (10:00 p.m. – 6:59 a.m.) for the Existing (2023) Baseline condition.

C.5.4 Flight Tracks

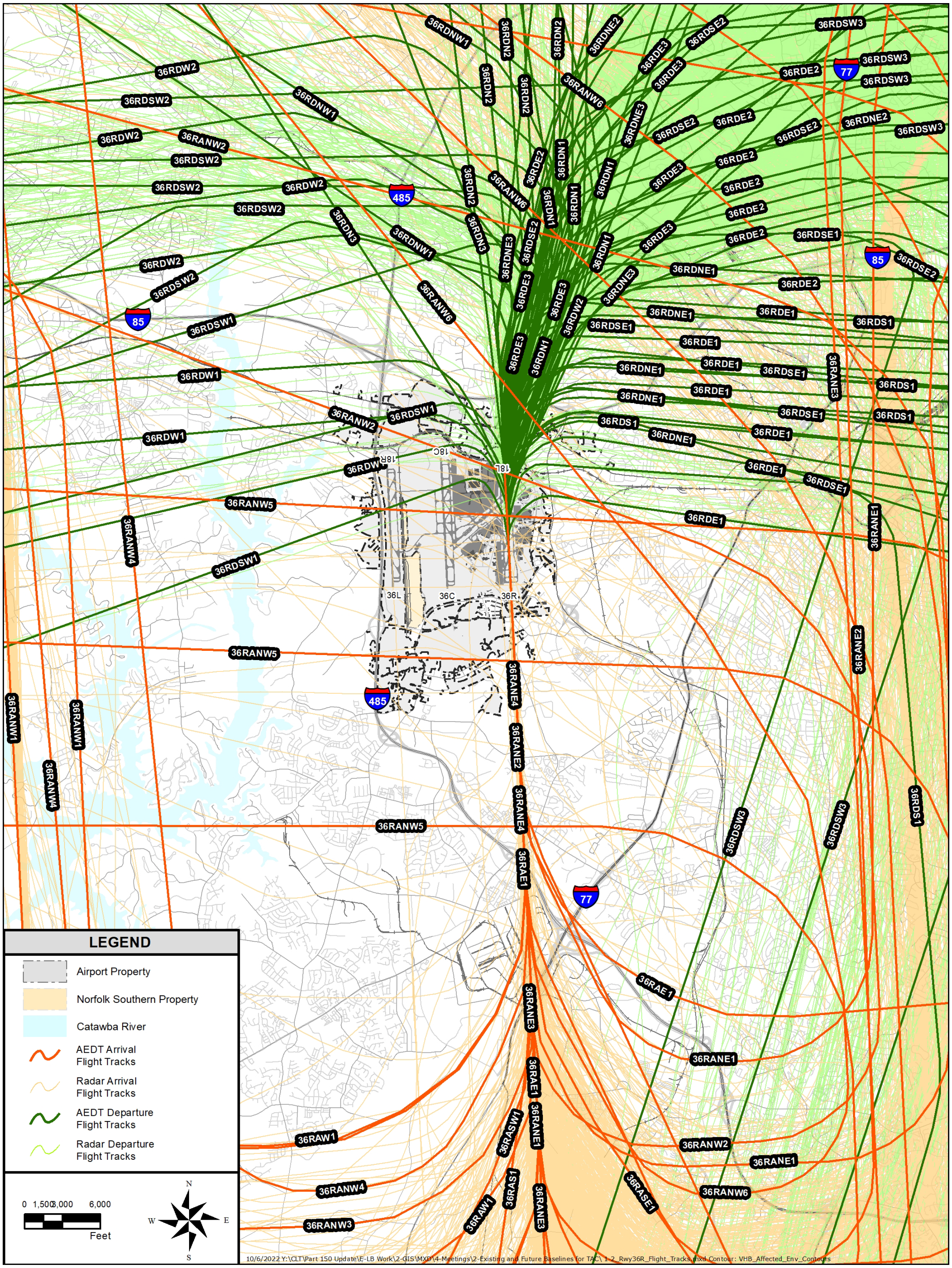
Flight tracks are built in the AEDT to model the noise levels of aircraft along each flight path to and from the runway ends. There are two components to modeling flight tracks, location, and percent distribution. Flight track locations were developed based on a review of radar data from the CLT Flight Tracking System. The percent use of each track was based on a review of radar data and previous studies. The AEDT flight tracks developed for the Existing (2023) Baseline condition are shown on **Exhibit C-11** through **Exhibit C-17**. **Table C-3, Arrival Flight Track Distribution – Existing (2023) Baseline** shows arrival flight track utilization percentages and **Table C-4, *Departure Flight Track Distribution – Existing (2023) Baseline*** shows departure flight track utilization percentages for the Existing (2023) Baseline condition. **Table C-5, *Helicopter Arrival Flight Track Distribution – Existing (2023) Baseline*** shows helicopter arrival flight track utilization percentages and **Table C-6, *Helicopter Departure Flight Track Distribution – Existing (2023) Baseline*** shows helicopter departure flight track utilization percentages for the Existing (2023) Baseline condition. Each flight track is identified by a track ID that corresponds to the label in the flight track exhibits.

Table C-2 Average Annual Day Runway Use – Existing (2023) Baseline

Aircraft Category	18C	18L	18R	36C	36L	36R	Total
Daytime Arrivals							
Heavy Passenger Jet	7.7%	26.5%	10.0%	11.6%	13.3%	30.9%	100.0%
Cargo Jet	4.6%	24.5%	16.5%	1.8%	16.9%	35.6%	100.0%
Large Passenger Jet	3.4%	15.2%	25.1%	4.8%	31.9%	19.6%	100.0%
Regional / GA Jet	2.0%	25.2%	16.8%	1.7%	20.4%	33.9%	100.0%
Commuter / Cargo / GA Prop	1.0%	40.5%	3.1%	0.6%	3.8%	51.0%	100.0%
Military	2.0%	33.8%	0.0%	2.0%	0.0%	62.2%	100.0%
Nighttime Arrivals							
Heavy Passenger Jet	33.3%	7.8%	2.0%	37.3%	0.0%	19.6%	100.0%
Cargo Jet	10.3%	34.7%	1.1%	10.9%	0.4%	42.5%	100.0%
Large Passenger Jet	20.3%	21.0%	4.9%	23.9%	4.4%	25.6%	100.0%
Regional / GA Jet	9.0%	33.3%	3.4%	9.2%	1.6%	43.5%	100.0%
Commuter / Cargo / GA Prop	6.0%	39.9%	0.7%	8.9%	0.4%	44.1%	100.0%
Military	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Daytime Departures							
Heavy Passenger Jet	25.2%	21.0%	0.0%	35.5%	0.0%	18.3%	100.0%
Cargo Jet	12.1%	30.2%	0.0%	7.0%	0.0%	50.7%	100.0%
Large Passenger Jet	26.2%	17.4%	0.0%	35.1%	0.0%	21.2%	100.0%
Regional / GA Jet	19.0%	24.6%	0.0%	25.7%	0.0%	30.8%	100.0%
Commuter / Cargo / GA Prop	2.8%	41.1%	0.0%	5.5%	0.0%	50.6%	100.0%
Military	2.0%	33.8%	0.0%	2.0%	0.0%	62.2%	100.0%
Nighttime Departures							
Heavy Passenger Jet	21.9%	25.0%	0.0%	40.6%	0.0%	12.5%	100.0%
Cargo Jet	13.1%	32.1%	0.0%	9.8%	0.0%	45.0%	100.0%
Large Passenger Jet	26.6%	23.4%	0.0%	29.4%	0.0%	20.5%	100.0%
Regional / GA Jet	21.1%	29.2%	0.0%	22.8%	0.0%	26.9%	100.0%
Commuter / Cargo / GA Prop	6.5%	44.8%	0.0%	7.8%	0.0%	40.9%	100.0%
Military	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

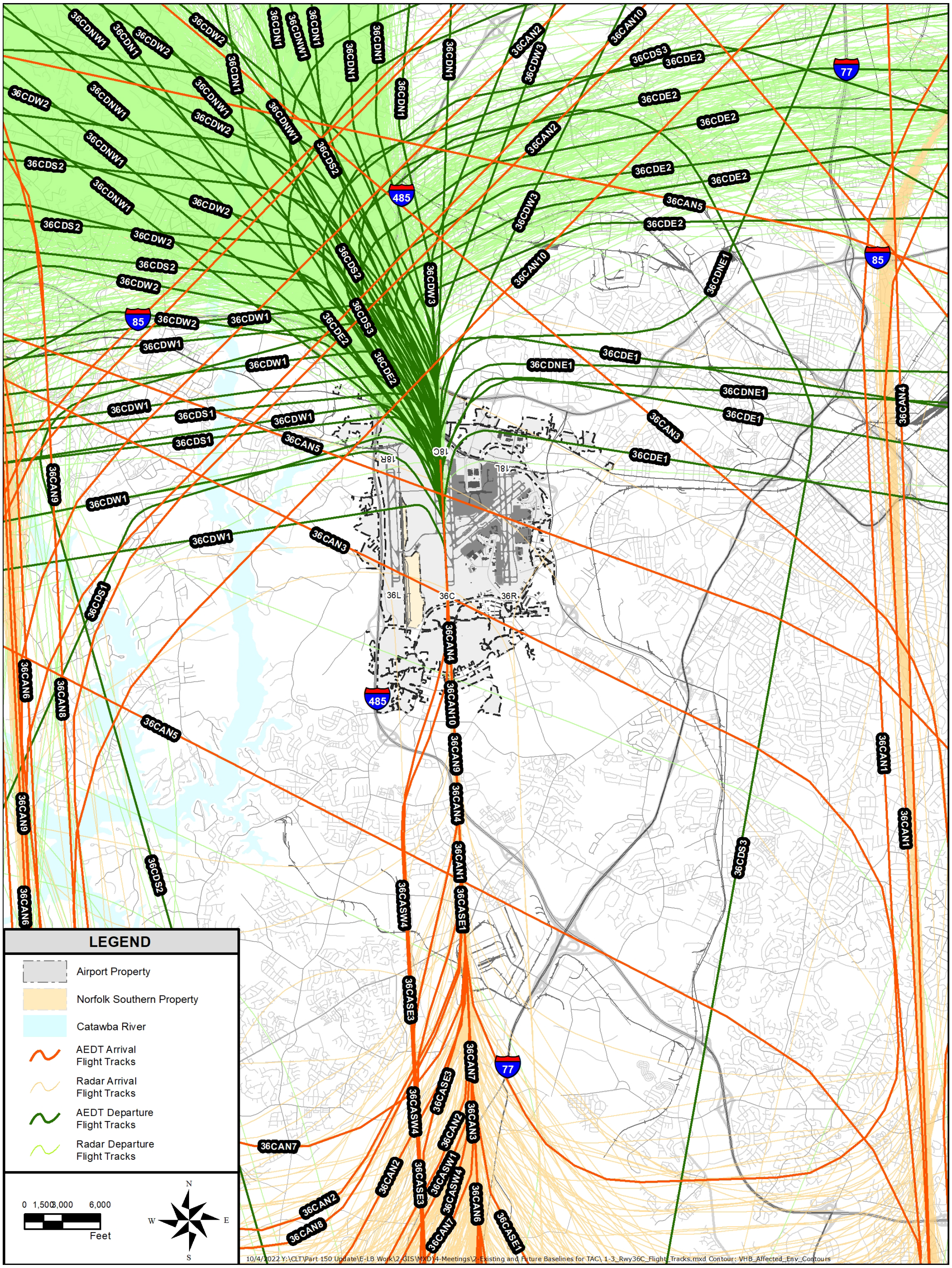
Note: Totals may not equal sum due to rounding.
Source: CLT Flight Tracking System Data, Landrum & Brown analysis, 2022.

Exhibit C-11 Runway 36R Flight Tracks – Existing (2023) Baseline



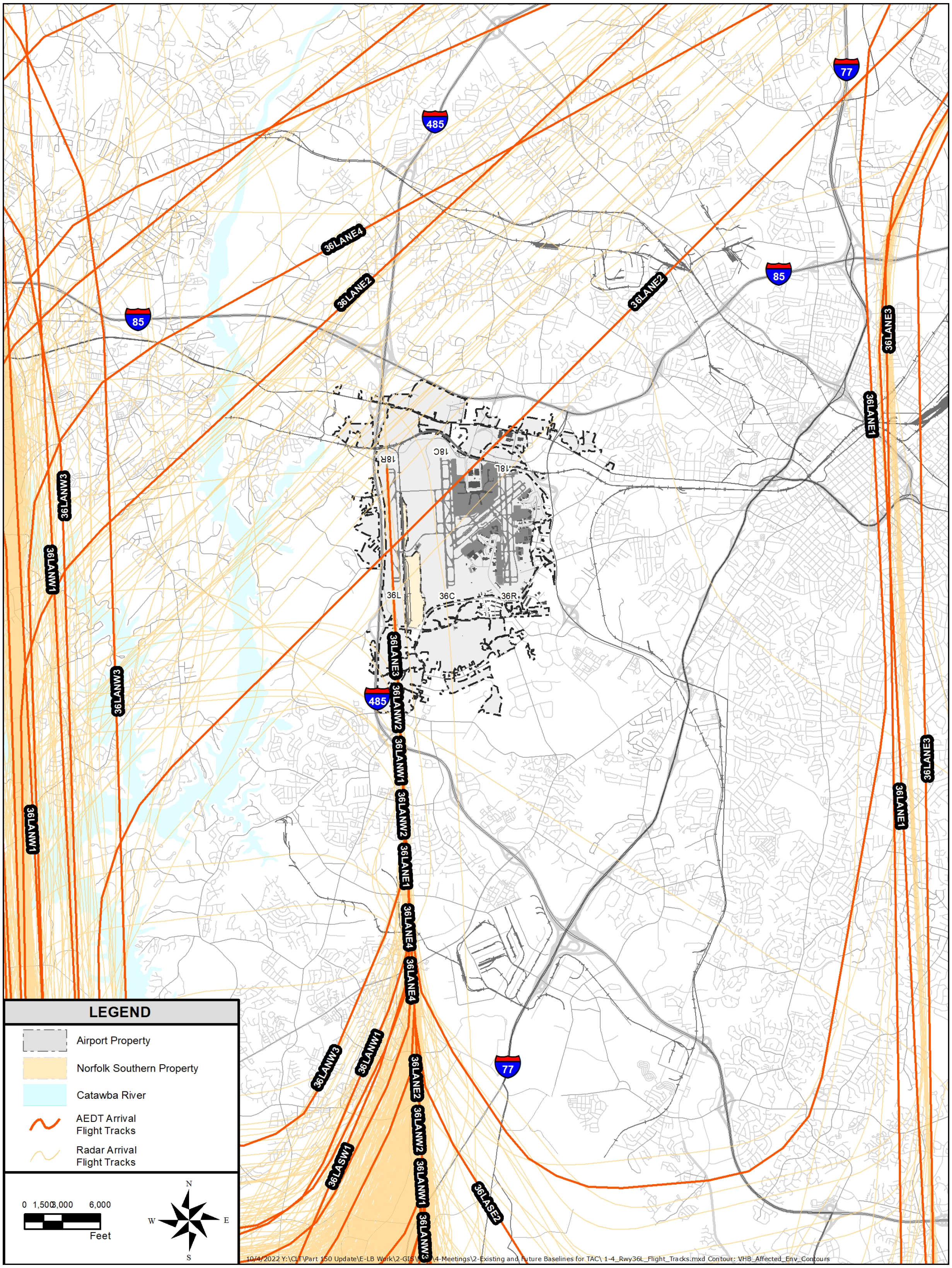
Source: Landrum & Brown, 2022

Exhibit C-12 Runway 36C Flight Tracks – Existing (2023) Baseline



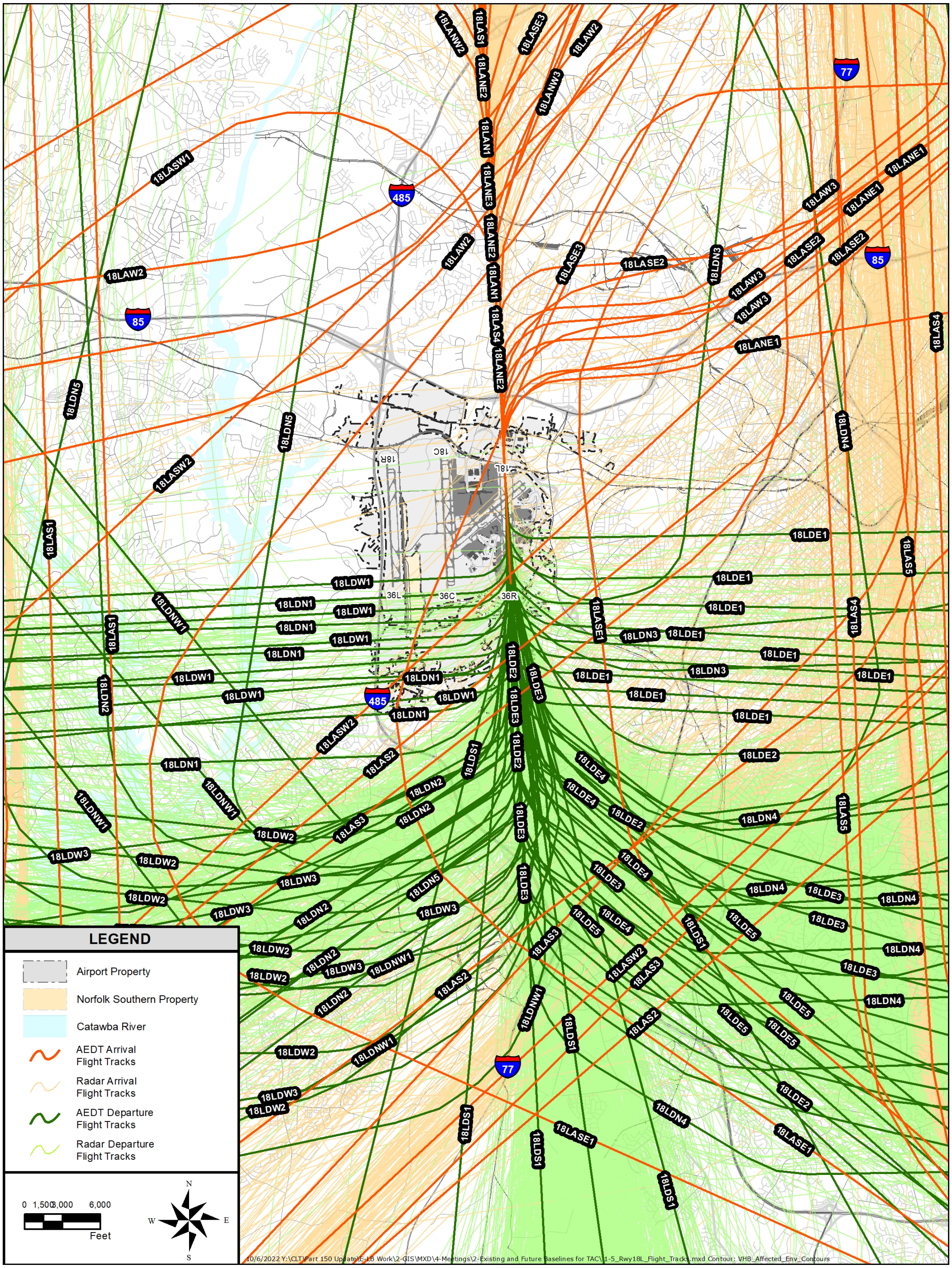
Source: Landrum & Brown, 2022

Exhibit C-13 Runway 36L Flight Tracks – Existing (2023) Baseline



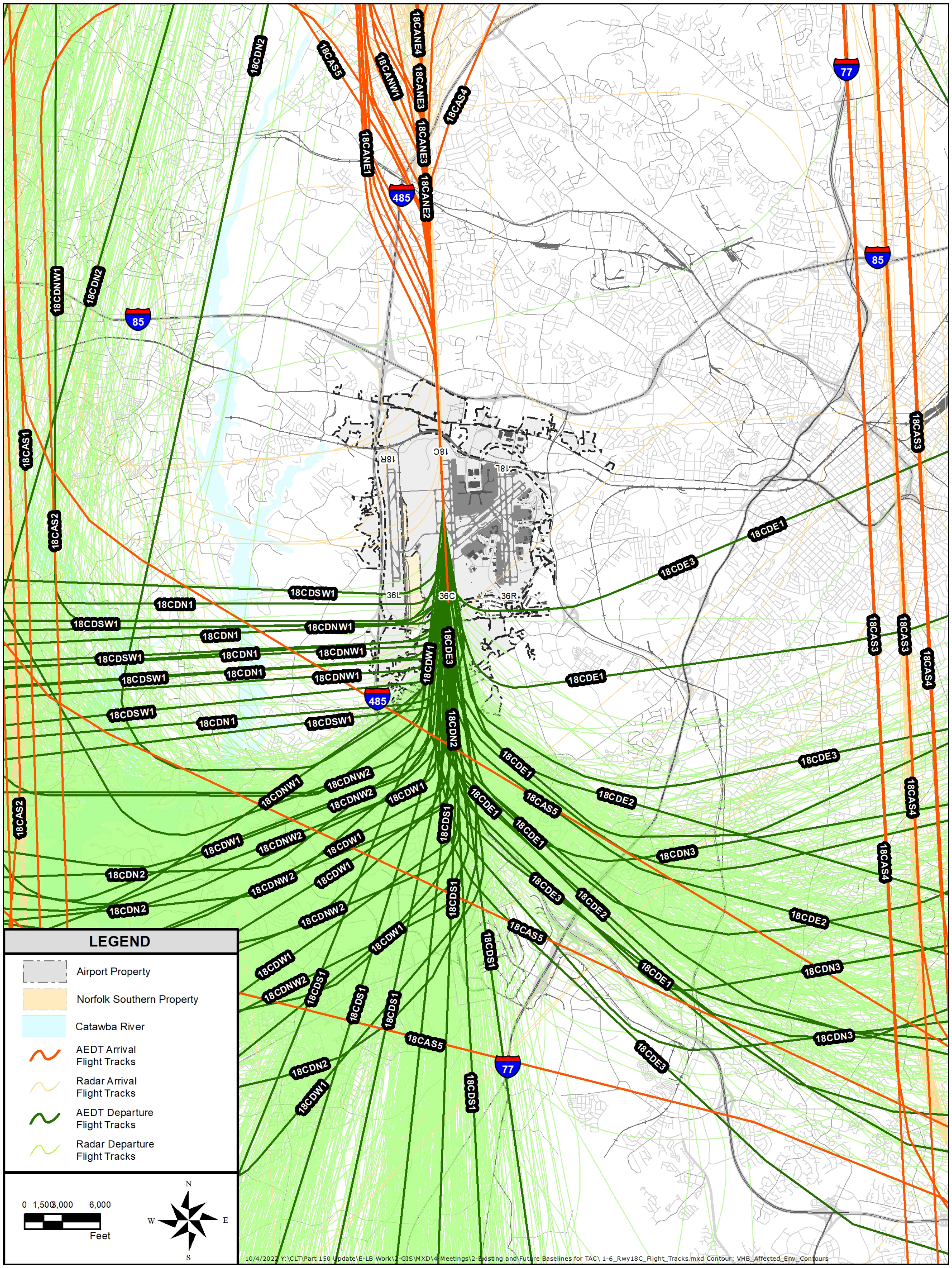
Source: Landrum & Brown, 2022

Exhibit C-14 Runway 18L Flight Tracks – Existing (2023) Baseline



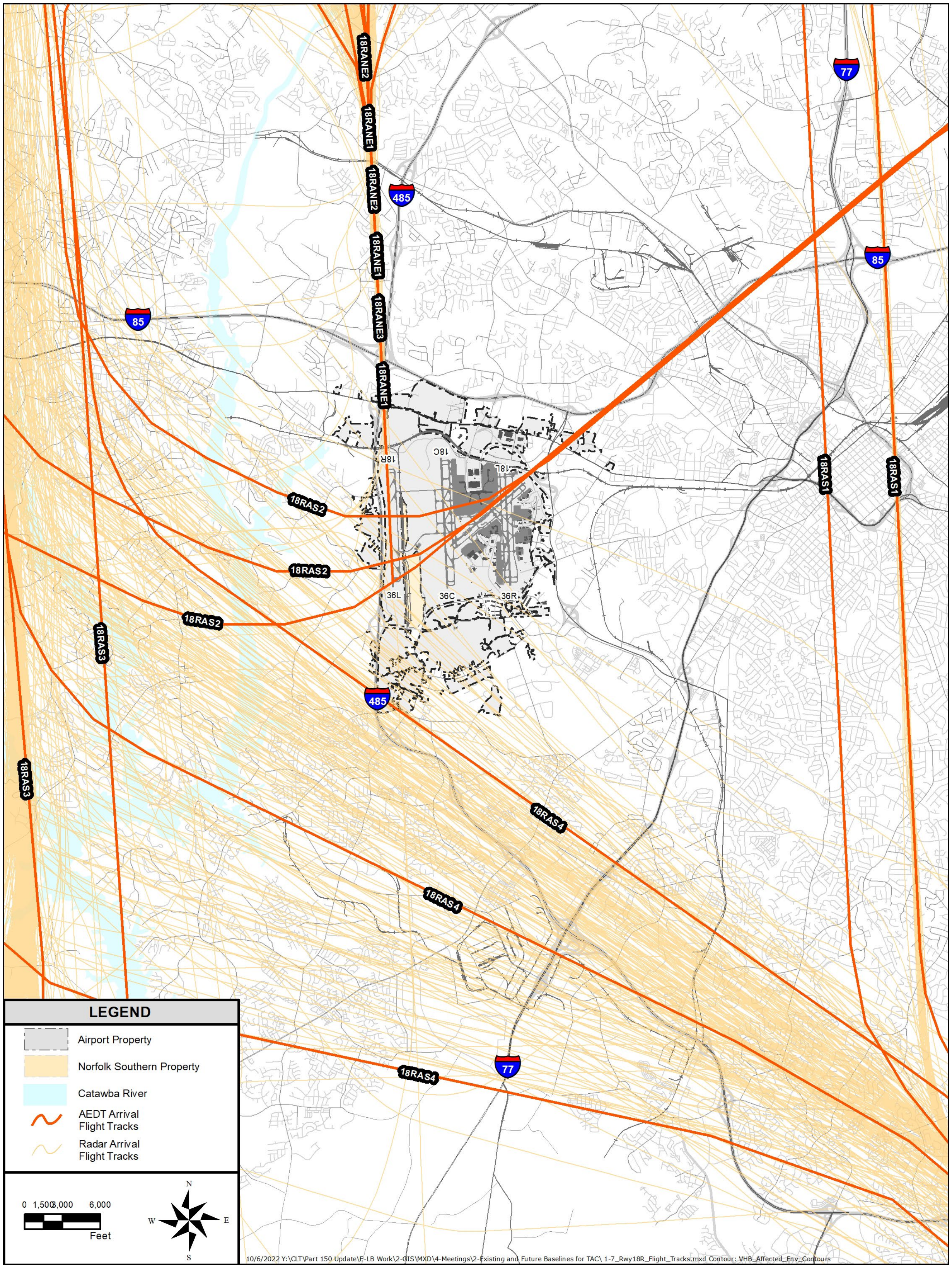
Source: Landrum & Brown, 2022

Exhibit C-15 Runway 18C Flight Tracks – Existing (2023) Baseline



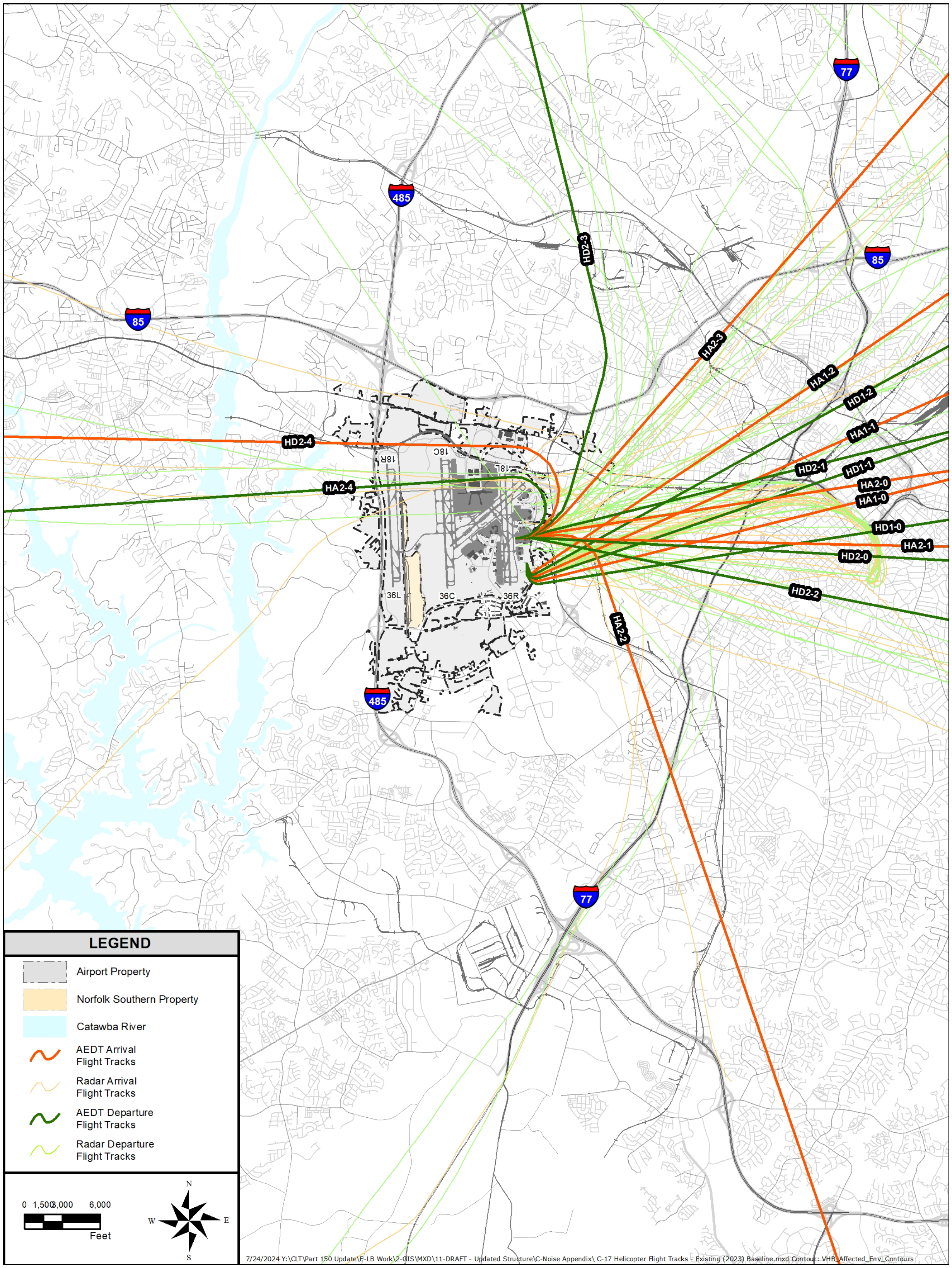
Source: Landrum & Brown, 2022

Exhibit C-16 Runway 18R Flight Tracks – Existing (2023) Baseline



Source: Landrum & Brown, 2022

Exhibit C-17 Helicopter Flight Tracks – Existing (2023) Baseline



Source: Landrum & Brown, 2022

Table C-3 Arrival Flight Track Distribution – Existing (2023) Baseline

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
18L	18LAN1	0.3%	3.4%	0.3%	0.0%	0.0%	0.0%
	18LANE1	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%
	18LANE2	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%
	18LANE3	22.8%	14.0%	22.8%	29.2%	29.2%	29.2%
	18LANE4	19.6%	18.5%	19.6%	8.6%	8.6%	8.6%
	18LANE5	1.3%	3.3%	1.3%	3.2%	3.2%	3.2%
	18LANE6	3.2%	2.8%	3.2%	0.0%	0.0%	0.0%
	18LANW1	0.3%	3.2%	0.3%	0.0%	0.0%	0.0%
	18LANW2	1.0%	5.6%	1.0%	0.0%	0.0%	0.0%
	18LANW3	0.1%	0.7%	0.1%	5.2%	5.2%	5.2%
	18LAS1	2.4%	4.5%	2.4%	5.2%	5.2%	5.2%
	18LAS2	0.9%	3.4%	0.9%	3.0%	3.0%	3.0%
	18LAS3	2.5%	2.1%	2.5%	4.3%	4.3%	4.3%
	18LAS4	21.6%	9.2%	21.6%	1.9%	1.9%	1.9%
	18LAS5	16.8%	13.5%	16.8%	8.1%	8.1%	8.1%
	18LASE1	0.8%	0.1%	0.8%	3.2%	3.2%	3.2%
	18LASE2	0.1%	0.9%	0.1%	0.0%	0.0%	0.0%
	18LASE3	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
	18LASW1	0.6%	0.6%	0.6%	0.0%	0.0%	0.0%
	18LASW2	0.0%	0.4%	0.0%	1.1%	1.1%	1.1%
	18LAW1	5.8%	9.1%	5.8%	26.8%	26.8%	26.8%
	18LAW2	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%
	18LAW3	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%
18L Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
18C	18CANE1	0.4%	0.1%	0.4%	0.0%	0.0%	0.0%
	18CANE2	0.8%	0.1%	0.8%	0.1%	0.1%	0.1%
	18CANE3	13.6%	5.0%	13.6%	1.1%	1.1%	1.1%
	18CANE4	7.6%	4.0%	7.6%	0.7%	0.7%	0.7%
	18CANW1	1.1%	1.3%	1.1%	0.1%	0.1%	0.1%
	18CANW2	1.2%	1.0%	1.2%	0.0%	0.0%	0.0%
	18CANW3	7.1%	9.1%	7.1%	0.2%	0.2%	0.2%
	18CANW4	0.6%	1.1%	0.6%	0.0%	0.0%	0.0%
	18CANW5	15.3%	23.6%	15.3%	1.2%	1.2%	1.2%
	18CAS1	2.3%	6.3%	2.3%	0.0%	0.0%	0.0%
	18CAS2	13.7%	14.5%	13.7%	9.5%	9.5%	9.5%
	18CAS3	0.2%	0.2%	0.2%	1.5%	1.5%	1.5%
	18CAS4	3.0%	1.1%	3.0%	0.0%	0.0%	0.0%
	18CAS5	0.7%	0.3%	0.7%	2.4%	2.4%	2.4%
	18CASW1	2.2%	0.2%	2.2%	7.1%	7.1%	7.1%
	18CAW1	2.5%	4.1%	2.5%	21.2%	21.2%	21.2%
	18CAW2	2.5%	3.1%	2.5%	11.8%	11.8%	11.8%
	18CAW3	25.1%	25.0%	25.1%	43.0%	43.0%	43.0%

Table C-3 Arrival Flight Track Distribution – Existing (2023) Baseline *(Continued)*

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
18R	18RANE1	2.3%	1.8%	2.3%	0.0%	0.0%	0.0%
	18RANE2	1.0%	1.2%	1.0%	0.0%	0.0%	0.0%
	18RANE3	7.6%	6.9%	7.6%	0.0%	0.0%	0.0%
	18RANW1	7.3%	13.4%	7.3%	0.1%	0.1%	0.0%
	18RANW2	1.1%	1.4%	1.1%	0.1%	0.1%	0.0%
	18RANW3	8.2%	12.7%	8.2%	0.0%	0.0%	0.0%
	18RANW4	0.3%	0.3%	0.3%	0.8%	0.8%	0.0%
	18RAS1	2.2%	0.9%	2.2%	1.3%	1.3%	0.0%
	18RAS2	0.1%	0.0%	0.1%	0.2%	0.2%	0.0%
	18RAS3	34.3%	18.9%	34.3%	50.5%	50.5%	0.0%
	18RAS4	3.7%	1.7%	3.7%	2.0%	2.0%	0.0%
	18RAW1	6.0%	8.7%	6.0%	10.4%	10.4%	0.0%
	18RAW2	0.2%	0.4%	0.2%	0.5%	0.5%	0.0%
	18RAW3	25.8%	31.7%	25.8%	34.0%	34.0%	0.0%
18R Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	0.0%
36R	36RAE1	0.1%	0.4%	0.1%	0.2%	0.2%	0.2%
	36RANE1	4.7%	4.5%	4.7%	2.1%	2.1%	2.1%
	36RANE2	27.8%	20.2%	27.8%	5.4%	5.4%	5.4%
	36RANE3	38.6%	23.1%	38.6%	8.3%	8.3%	8.3%
	36RANE4	0.1%	0.8%	0.1%	0.0%	0.0%	0.0%
	36RANW1	3.3%	3.5%	3.3%	1.7%	1.7%	1.7%
	36RANW2	0.3%	2.3%	0.3%	7.0%	7.0%	7.0%
	36RANW3	0.9%	0.5%	0.9%	1.2%	1.2%	1.2%
	36RANW4	0.7%	2.0%	0.7%	6.7%	6.7%	6.7%
	36RANW5	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%
	36RANW6	3.8%	7.0%	3.8%	13.3%	13.3%	13.3%
	36RAS1	0.5%	1.0%	0.5%	0.5%	0.5%	0.5%
	36RASE1	12.2%	17.0%	12.2%	27.3%	27.3%	27.3%
	36RASE2	5.5%	10.5%	5.5%	16.3%	16.3%	16.3%
	36RASW1	1.2%	4.1%	1.2%	9.7%	9.7%	9.7%
	36RASW2	0.2%	2.2%	0.2%	0.2%	0.2%	0.2%
	36RAW1	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%
	36RAW2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
36R Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table C-3 Arrival Flight Track Distribution – Existing (2023) Baseline *(Continued)*

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
36C	36CAN1	13.0%	6.1%	13.0%	0.1%	0.1%	0.1%
	36CAN2	0.3%	0.2%	0.3%	0.0%	0.0%	0.0%
	36CAN4	0.4%	0.0%	0.4%	0.0%	0.0%	0.0%
	36CAN5	0.7%	0.7%	0.7%	0.0%	0.0%	0.0%
	36CAN7	1.1%	1.4%	1.1%	8.4%	8.4%	8.4%
	36CAN8	0.0%	1.5%	0.0%	0.0%	0.0%	0.0%
	36CAN9	0.5%	1.4%	0.5%	0.0%	0.0%	0.0%
	36CAN10	3.9%	0.5%	3.9%	0.0%	0.0%	0.0%
	36CASE1	26.6%	26.7%	26.6%	0.3%	0.3%	0.3%
	36CASE2	14.3%	14.3%	14.3%	0.0%	0.0%	0.0%
	36CASE3	3.7%	5.1%	3.7%	0.0%	0.0%	0.0%
	36CASW1	5.7%	15.0%	5.7%	0.1%	0.1%	0.1%
	36CASW2	0.4%	0.5%	0.4%	1.6%	1.6%	1.6%
	36CASW3	11.6%	3.4%	11.6%	4.9%	4.9%	4.9%
	36CASW4	7.1%	17.4%	7.1%	44.8%	44.8%	44.8%
	36CASW5	6.0%	2.1%	6.0%	26.8%	26.8%	26.8%
	36CAN3	1.1%	0.7%	1.1%	4.8%	4.8%	4.8%
	36CAN6	3.7%	3.0%	3.7%	8.0%	8.0%	8.0%
36C Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
36L	36RAW2	2.5%	3.7%	2.5%	54.0%	54.0%	0.0%
	36RAW3	2.0%	1.7%	2.0%	0.3%	0.3%	0.0%
	36RAW4	0.3%	0.3%	0.3%	0.0%	0.0%	0.0%
	36RAW5	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%
	36RAW6	12.7%	31.0%	12.7%	2.8%	2.8%	0.0%
	36RAW7	0.1%	0.2%	0.1%	0.0%	0.0%	0.0%
	36RAW8	38.3%	31.2%	38.3%	15.9%	15.9%	0.0%
	36RAW9	6.1%	2.3%	6.1%	0.7%	0.7%	0.0%
	36RAW10	1.9%	0.4%	1.9%	0.2%	0.2%	0.0%
	36RAW11	3.6%	1.5%	3.6%	0.4%	0.4%	0.0%
	36RAW12	5.1%	5.3%	5.1%	0.7%	0.7%	0.0%
	36RAW13	12.5%	11.5%	12.5%	9.1%	9.1%	0.0%
	36RAW14	14.9%	10.9%	14.9%	15.8%	15.8%	0.0%
36L Subtotal		100.0%	100.00%	100.00%	100.00%	100.00%	0.00%

Note: Totals may not equal sum due to rounding.
Source: Landrum & Brown, 2024

Table C-4 Departure Flight Track Distribution – Existing (2023) Baseline

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
18L	18LDE1	0.2%	3.3%	0.2%	0.0%	0.0%	33.3%
	18LDE2	39.6%	30.6%	39.6%	45.3%	45.3%	5.6%
	18LDE3	4.2%	4.9%	4.2%	23.2%	23.2%	0.0%
	18LDE4	1.0%	2.3%	1.0%	8.0%	8.0%	0.0%
	18LDE5	0.8%	0.5%	0.8%	3.7%	3.7%	0.0%
	18LDN1	0.0%	1.1%	0.0%	0.5%	0.5%	0.0%
	18LDN2	0.9%	3.1%	0.9%	2.1%	2.1%	0.0%
	18LDN3	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%
	18LDN4	7.2%	9.1%	7.2%	1.2%	1.2%	0.0%
	18LDN5	0.9%	0.8%	0.9%	0.0%	0.0%	0.0%
	18LDNW1	2.8%	3.8%	2.8%	4.7%	4.7%	0.0%
	18LDS1	40.8%	22.6%	40.8%	4.7%	4.7%	27.8%
	18LDW1	0.0%	2.8%	0.0%	0.0%	0.0%	33.3%
	18LDW2	1.0%	7.6%	1.0%	5.9%	5.9%	0.0%
	18LDW3	0.5%	7.0%	0.5%	0.6%	0.6%	0.0%
18L Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
18C	18CDE1	0.7%	1.3%	0.7%	0.0%	0.0%	0.0%
	18CDE2	0.2%	0.2%	0.2%	0.0%	0.0%	0.0%
	18CDE3	1.8%	1.4%	1.8%	0.0%	0.0%	0.0%
	18CDN1	0.1%	2.0%	0.1%	0.0%	0.0%	0.0%
	18CDN2	17.4%	20.5%	17.4%	17.1%	17.1%	0.0%
	18CDN3	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
	18CDNW1	0.2%	0.2%	0.2%	0.0%	0.0%	0.0%
	18CDNW2	16.7%	22.7%	16.7%	3.3%	3.3%	0.0%
	18CDS1	6.0%	2.6%	6.0%	0.0%	0.0%	6.4%
	18CDSW1	0.4%	0.2%	0.4%	0.0%	0.0%	3.3%
	18CDW1	56.3%	48.7%	56.3%	79.5%	79.5%	90.3%
18C Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
36R	36RDE1	0.2%	5.1%	0.2%	12.5%	12.5%	20.0%
	36RDE2	51.9%	38.6%	51.9%	5.5%	5.5%	40.0%
	36RDE3	22.1%	19.1%	22.1%	3.6%	3.6%	0.0%
	36RDN1	0.9%	2.2%	0.9%	3.5%	3.5%	0.0%
	36RDN2	0.7%	3.4%	0.7%	6.6%	6.6%	0.0%
	36RDN3	0.1%	0.2%	0.1%	0.5%	0.5%	0.0%
	36RDNE1	0.0%	0.5%	0.0%	1.5%	1.5%	0.0%
	36RDNE2	0.2%	0.9%	0.2%	2.1%	2.1%	0.0%
	36RDNE3	0.0%	0.3%	0.0%	1.6%	1.6%	0.0%
	36RDNW1	1.0%	2.4%	1.0%	15.4%	15.4%	0.0%
	36RDS1	0.4%	0.9%	0.4%	11.5%	11.5%	40.0%
	36RDSE1	0.0%	0.6%	0.0%	2.5%	2.5%	0.0%
	36RDSE2	9.5%	18.8%	9.5%	13.6%	13.6%	0.0%
	36RDSW1	0.1%	1.5%	0.1%	0.8%	0.8%	0.0%
	36RDSW2	1.5%	1.1%	1.5%	2.8%	2.8%	0.0%
	36RDSW3	8.9%	1.7%	8.9%	3.0%	3.0%	0.0%
	36RDW1	0.2%	1.1%	0.2%	5.9%	5.9%	0.0%
	36RDW2	2.4%	1.7%	2.4%	7.2%	7.2%	0.0%
36R Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table C-4 Departure Flight Track Distribution – Existing (2023) Baseline *(Continued)*

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
36C	36CDE1	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%
	36CDE2	3.0%	3.4%	3.0%	2.8%	2.8%	0.0%
	36CDN1	17.1%	24.0%	17.1%	51.1%	51.1%	0.0%
	36CDNE1	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
	36CDNW1	14.8%	19.5%	14.8%	33.7%	33.7%	0.0%
	36CDS1	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
	36CDS2	11.2%	6.4%	11.2%	9.8%	9.8%	0.0%
	36CDS3	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
	36CDW1	0.4%	0.8%	0.4%	0.6%	0.6%	66.7%
	36CDW2	53.3%	45.4%	53.3%	2.0%	2.0%	33.3%
	36CDW3	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
36C Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Totals may not equal sum due to rounding.
Source: Landrum & Brown, 2024

Table C-5 Helicopter Arrival Flight Track Distribution – Existing (2023) Baseline

Runway End	Track ID	Helicopter
HP-1	HA1-0	34.0%
	HA1-1	33.0%
	HA1-2	33.0%
	HP-1 Subtotal	100.0%
HP-2	HA2-0	35.0%
	HA2-1	35.0%
	HA2-2	5.0%
	HA2-3	20.0%
	HA2-4	5.0%
	HP-2 Subtotal	100.0%

Note: Totals may not equal sum due to rounding.
Source: Landrum & Brown, 2024

Table C-6 Helicopter Departure Flight Track Distribution – Existing (2023) Baseline

Runway End	Track ID	Helicopter
HP-1	HD1-0	34.0%
	HD1-1	33.0%
	HD1-2	33.0%
HP-1 Subtotal		100.0%
HP-2	HD2-0	30.0%
	HD2-1	30.0%
	HD2-2	30.0%
	HD2-3	5.0%
	HD2-4	5.0%
HP-2 Subtotal		100.0%

Note: Totals may not equal sum due to rounding.
Source: Landrum & Brown, 2022

C.5.5 Aircraft Weight and Trip Length

Aircraft weight upon departure is a factor in the dispersion of noise because it impacts the rate at which an aircraft is able to climb. Generally, heavier aircraft have a slower rate of climb and a wider dispersion of noise along their flight routes. Where specific aircraft weights are unknown, the AEDT uses the distance flown to the first stop as a surrogate for the weight, by assuming that the weight has a direct relationship with the fuel load necessary to reach the first destination. The AEDT groups trip lengths into eleven stage categories and assigns standard aircraft weights to each stage category. These categories are:

Stage Category	Stage Length
1	0-500 nautical miles
2	501-1000 nautical miles
3	1001-1500 nautical miles
4	1501-2500 nautical miles
5	2501-3500 nautical miles
6	3501-4500 nautical miles
7	4501-5500 nautical miles
8	5501-6500 nautical miles
9	6501-7500 nautical miles
10	7501-8500 nautical miles
11	8501+ nautical miles

The trip lengths developed for the Existing (2023) Baseline condition are based upon a review of radar data from the CLT Flight Tracking System for April 2021 through March 2022. During this time period, aircraft operations at the Airport were distributed within departure stage lengths one through six, as indicated in **Table C-7, *Departure Stage Length – Existing (2023) Baseline***.

Table C-7 Departure Stage Length – Existing (2023) Baseline

Aircraft Category	Departure Stage Length					
	1	2	3	4	5	6
Heavy Passenger Jet	1%	33%	4%	0%	24%	38%
Cargo Jet	97%	3%	0%	0%	0%	0%
Large Passenger Jet	60%	30%	4%	6%	0%	0%
Regional / GA Jet	96%	3%	0%	0%	0%	0%
Commuter / Cargo / GA Prop	100%	0%	0%	0%	0%	0%
Military	100%	0%	0%	0%	0%	0%

Note: Totals may not equal sum due to rounding.
Source: Landrum & Brown, 2022

C.5.6 Ground Run-Up Activity

Engine run-ups are conducted at CLT for maintenance purposes on civil and military aircraft at aircraft maintenance ramps or on the taxiways at CLT. Military run-ups occur at the North Carolina Air National Guard (NCANG) ramp and civil run-ups typically occur at one of five locations on the airfield[16] as listed below in **Table C-8, *Aircraft Engine Run-Up Locations*** and shown on **Exhibit C-18, *Run-Up Locations – Existing (2023) Baseline.***

Table C-8 Aircraft Engine Run-Up Locations

Map ID	Run-Up Location Description
1	Taxiway E between approach of Runway 18C and Taxiway E12
2	West pad of former Runway 5/23
3	Center pad of former Runway 5/23
4	Taxiway C between Taxiway C1 and C3
5	Taxiway M between Taxiway M3 and D
6	NCANG Ramp

Engine run-ups activity was developed based on a review of run-up activity data at the Airport. Approximately 21.5 run-ups are anticipated to occur at the Airport per day. It was assumed that each civil run-up is conducted at low power (50 percent thrust) for up to 20 minutes, and at high power (100 percent thrust) for up to three additional minutes, for a total duration of 23 minutes per run-up. It was assumed that each military run-up is conducted at high power (100 percent thrust) for 30 minutes.

It was assumed that approximately 60 percent of all civil run-ups and 100 percent of all military run-ups occur during the daytime (7:00 am to 9:59 pm). Additionally, it was assumed civil run-up activity would be distributed between the run-up locations, with 40 percent on Taxiway M, 20 percent on Taxiway E, 15 percent on the former Runway 5/23 west pad, 15 percent on the former Runway 5/23 center pad, and ten percent on Taxiway C. Aircraft types for which run-up activity was estimated represent the most common aircraft that are operated at CLT by civil and military operators. **Table C-9, *Aircraft Engine Run-Ups - Existing (2023) Baseline*** shows the number, types, durations and times of day of engine run-ups for the Existing (2023) Baseline condition.

[16] Civil engine run-up locations on the taxiways are identified based on the FAA Tower Order (Order CTL 1050.1j) and information provided by the Airport.

Table C-9 Aircraft Engine Run-Ups - Existing (2023) Baseline

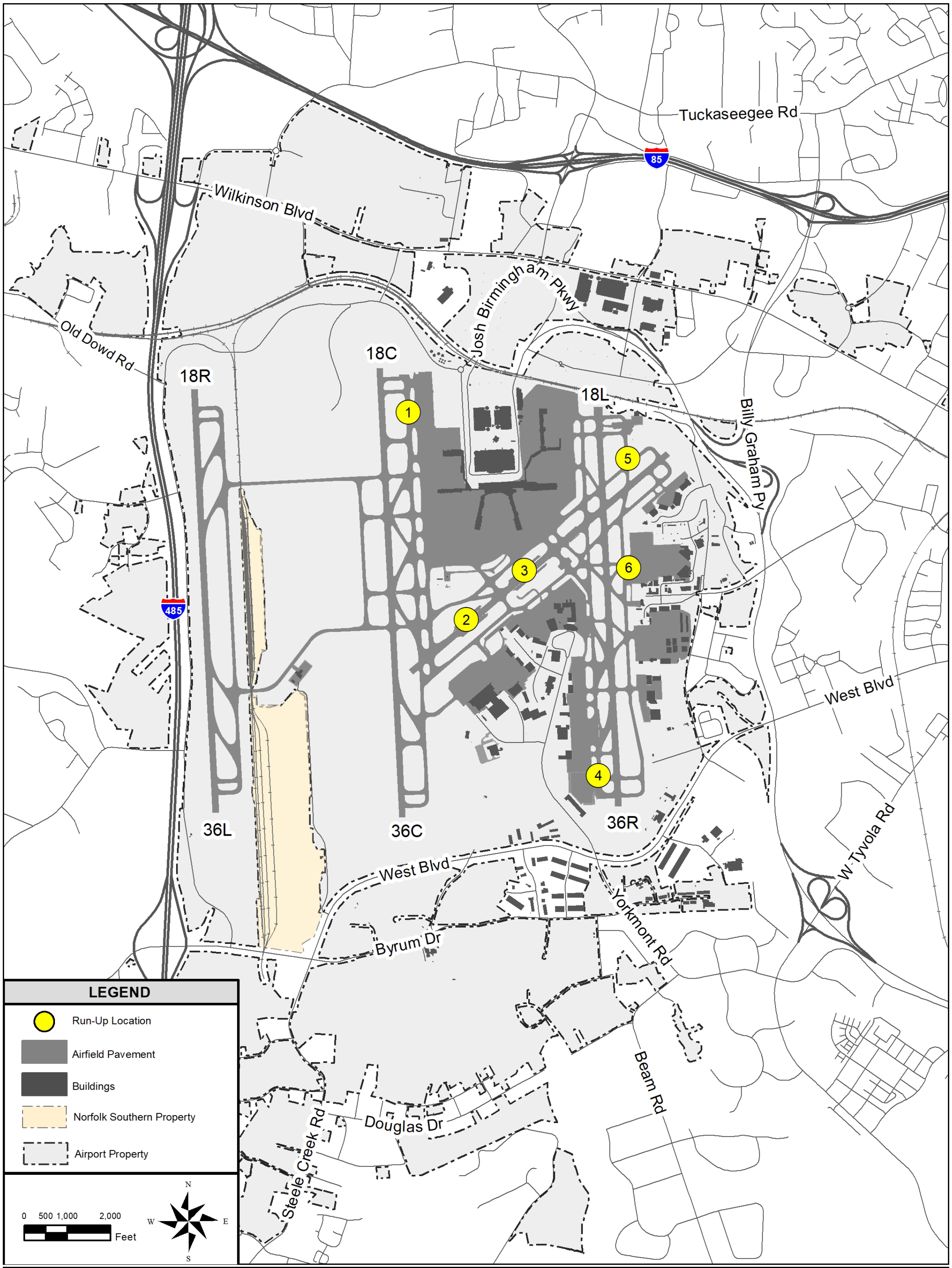
AEDT Aircraft ID	Run-Ups per Day			
	Daytime	Nighttime	Total Run-ups	Total Duration *(h:mm:ss)*
Civil Run-Ups				
Airbus A319-100 Series	0.99	0.66	1.65	0:18:58
Airbus A320-200 Series	0.56	0.37	0.93	0:10:40
Airbus A321-200 Series	2.08	1.39	3.47	0:39:56
Boeing 737-800 Series	1.44	0.96	2.40	0:27:37
Boeing 777-200-ER	0.11	0.08	0.19	0:02:11
Bombardier CRJ-900-ER	4.19	2.79	6.98	1:20:15
Embraer ERJ145-LR	1.98	1.32	3.31	0:38:01
Embraer ERJ175-LR	1.19	0.79	1.98	0:22:43
Subtotal	*12.54*	*8.36*	*20.9*	*4:00:21*
Military Run-Ups				
Boeing C-17A	0.56	0.0	0.56	0:16:52
Subtotal	*0.56*	*0.0*	*0.56*	*0:16:52*
Total	**13.10**	**8.36**	**21.46**	**4:17:13**

Source: FAA Order CLT 7110.65V, Landrum & Brown analysis, 2022.

C.5.7 Comparability of Conditions

As previously stated, total operations used in the modeling of the Existing (2023) Baseline condition are based on actual operating levels for the period of April 2021 through March 2022. The total annual operations during this period was 526,454. The FAA's Terminal Area Forecast (TAF) reported a total of 541,560 operations for the most recent 12 months for which data was available at the time of this writing (March 2023 to February 2024). The difference between the annual operations used to model the Existing (2023) Baseline condition and those for the FAA's TAF for March 2023 to February 2024 is 15,106 operations (2.8 percent difference). As such, the operating levels used to prepare the Existing (2023) Baseline are essentially the same as the operating levels for the last 12 months. Runway 5/23 was minimally used during the period of April 2021 through March 2022 and was decommissioned in 2022; as such, Runway 5/23 was assumed not operational in the Existing (2023) Baseline. Furthermore, no significant changes in runway use, fleet mix, or flight tracks have occurred. Therefore, the Existing (2023) Baseline condition is representative of the operating conditions for the last 12 months (March 2023 to February 2024).

Exhibit C-18 Run-Up Locations – Existing (2023) Baseline



Source: Landrum & Brown, 2022

C.6 Future (2028) Baseline Noise Exposure Contour

The following sections describe the noise modeling methodology and assumptions for the Future (2028) Baseline Noise Exposure Contours at CLT. Data representative of an average-annual day of operations was obtained from an aviation of forecast. This data included the number of operations by individual types of aircraft user classes.

C.6.1 Runway Definition

The Future (2028) Baseline condition includes the implementation of a new 10,000-foot runway (designated Runway 01/19) in the midfield with 3,200 feet of separation to Runway 18R/36L and 1,100 feet of separation to Runway 18C/36C. The Future (2028) Baseline condition additionally includes the implementation of other airfield improvement projects currently in design or construction.[17] The airfield layout for Future (2028) Baseline is shown on **Exhibit C-19 *Airport Layout – Future (2028) Baseline***. The runways and lengths at CLT for the Future (2028) Baseline are listed below:

Runway	Length (feet)
18L/36R	8,676
18C/36C	10,000
18R/36L	9,000
01/19	10,000

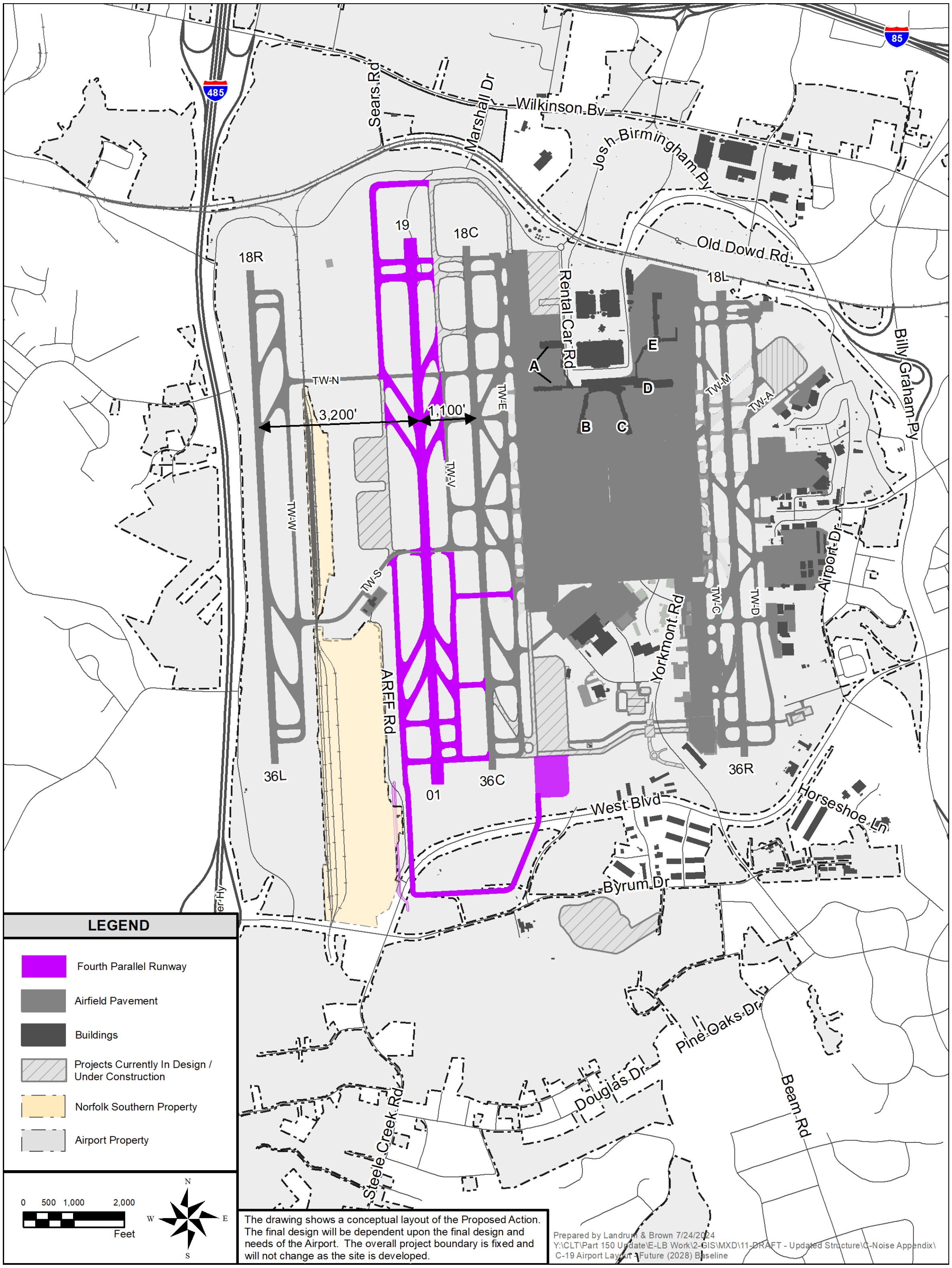
C.6.2 Number of Operations and Fleet Mix

The number of annual operations estimated for the Future (2028) Baseline was based on the latest forecast of aviation activity prepared for the Capacity Enhancement Projects Environmental Assessment.[18] That forecast included 639,783 total annual operations in 2028, or 1,752.8 average-annual day operations. Specific aircraft types and times of operation for commercial aircraft were developed from the future design day schedules prepared for that forecast. The future design day flight schedules provided peak operating levels by aircraft type and time of day. These peak levels were converted to an average-annual day for modeling the Future (2028) Baseline. **Table C-10, *Distribution of Average Daily Operations By Aircraft Type - Future (2028) Baseline*** shows the number of aircraft operations during the daytime (7:00 a.m. – 9:59 p.m.) and nighttime (10:00 p.m. – 6:59 a.m.) developed for the Future (2028) Baseline.

17 The future airfield layout includes the construction of a new fourth parallel runway, which is designated Runway 1/19 for this analysis.

18 Forecast Technical Memorandum, Technical Memorandum – Final, Charlotte Douglas International Airport Environmental Impact Statement, VHB in association with InterVISTAS, April 18, 2018.

Exhibit C-19 Airport Layout – Future (2028) Baseline



Source: Landrum & Brown, 2022

Table C-10 Distribution of Average Daily Operations by Aircraft Type - Future (2028) Baseline

AEDT Airframe Type	AEDT Engine Code	Arrivals		Departures		Total
		Daytime	Nighttime	Daytime	Nighttime	
Heavy Passenger Jets						
Airbus A330-200 Series	2RR023	3.6	0.0	3.7	0.0	7.3
Airbus A350-900 Series	01P18RR124	0.8	0.0	0.6	0.0	1.4
Boeing 787-9 Dreamliner	01P17GE211	3.6	0.0	3.7	0.0	7.3
Subtotal		*8.0*	*0.0*	*8.0*	*0.0*	*16.0*
Cargo Jet						
Airbus A300F4-600 Series	1PW048	1.7	1.0	1.2	1.6	5.5
Airbus A300F4-600 Series	2GE039	1.3	0.8	0.9	1.1	4.1
Boeing MD-10-1 Freighter	1GE001	0.5	0.3	0.4	0.4	1.6
Subtotal		*3.5*	*2.1*	*2.5*	*3.1*	*11.2*
Large Passenger Jet						
Airbus A319-100 Series	2CM019	59.3	5.1	57.1	7.2	128.7
Airbus A319-100 Series	3IA007	40.2	3.4	38.6	5	87.2
Airbus A320-100 Series	1IA003	5.6	0.6	5.4	0.7	12.3
Airbus A320-100 Series	2CM014	5.8	0.4	5.6	0.7	12.5
Airbus A320-200 Series	1CM009	2.7	0.2	2.6	0.3	5.8
Airbus A320-200 Series	1IA003	0.7	0.1	0.6	0.1	1.5
Airbus A321-200 Series	3CM025	40.3	3.4	38.8	5	87.5
Airbus A321-200 Series	3IA008	60.5	5.2	58.1	7.5	131.3
Airbus A321-NEO	01P08CM103	19.5	1.7	18.7	2.4	42.3
Boeing 717-200 Series	4BR002	4.7	0.4	4.5	0.6	10.2
Boeing 737-700 Series	3CM031	5.4	0.4	5.2	0.7	11.7
Boeing 737-8	01P20CM135	0.7	0.1	0.6	0.1	1.5
Boeing 737-8	01P20CM137	25.5	2.2	24.5	3.2	55.4
Boeing 737-800 Series	3CM032	7.4	0.6	7.1	0.9	16.0
Boeing 737-9	01P20CM136	1.3	0.1	1.3	0.2	2.9
Boeing MD-90	1IA002	1.3	0.1	1.3	0.2	2.9
Bombardier CRJ-700-ER	5GE083	114.9	9.8	110.5	14.3	249.5
Bombardier CRJ-700-LR	01P08GE190	1.3	0.1	1.3	0.2	2.9
Bombardier CRJ-900-ER	01P08GE190	147.2	12.5	141.5	18.3	319.5
Embraer ERJ170	01P08GE197	3.4	0.3	3.2	0.4	7.3
Embraer ERJ175	01P08GE197	43	3.7	41.4	5.3	93.4
Embraer ERJ190-AR	10GE129	5.4	0.5	5.1	0.7	11.7
Subtotal		*596.1*	*50.9*	*573.0*	*74.0*	*1,294.0*
Regional Jet						
Bombardier CRJ-200-LR	01P05GE189	112.0	6.2	109.0	9.1	236.3
Embraer ERJ145	6AL008	5.0	0.3	4.9	0.5	10.7
Subtotal		*117.0*	*6.5*	*113.9*	*9.6*	*247.0*
Commuter / Cargo Prop						
Cessna T303 Crusader (FAS)	TIO540	0.7	0.1	0.6	0.2	1.6
Cirrus SR22 Turbo (FAS)	TIO540	0.7	0.1	0.6	0.2	1.6
DAHER TBM 900/930	PT6A66	0.7	0.1	0.6	0.2	1.6
Embraer EMB120 Brasilia	PW118	4.8	0.7	3.8	1.3	10.6
Pilatus PC-12	PT6A67	4.4	0.4	3.2	1.5	9.5
Raytheon Beech Baron 58	TIO540	0.7	0.1	0.6	0.2	1.6
Raytheon King Air 90	PT6A60	0.7	0.1	0.6	0.2	1.6
Raytheon Super King Air 300	PT6A60	2.4	0.2	1.8	0.9	5.3
SOCATA TBM 850	PT6A66	0.7	0.1	0.5	0.3	1.6
Subtotal		*15.8*	*1.9*	*12.3*	*5.0*	*35.0*

Table C-10 Distribution of Average Daily Operations by Aircraft Type - Future (2028) Baseline *(Continued)*

AEDT Airframe Type	AEDT Engine Code	Arrivals		Departures		Total
		Daytime	Nighttime	Daytime	Nighttime	
General Aviation Regional Jet						
Bombardier Challenger 300	11HN003	4.7	0.3	4.7	0.4	10.1
Bombardier Challenger 600	01P05GE189	0.7	0.0	0.7	0.1	1.5
Bombardier Global Express	01P04BR013	3.3	0.3	3.2	0.2	7.0
Bombardier Learjet 45	1AS001	5.0	0.3	5.0	0.3	10.6
Bombardier Learjet 60	7PW077	0.8	0.0	0.7	0.1	1.6
Cessna 550 Citation II	1PW036	1.5	0.1	1.5	0.1	3.2
Cessna 560 Citation Excel	PW530	2.3	0.1	2.3	0.2	4.9
Cessna 560 Citation V	1PW037	2.3	0.1	2.2	0.2	4.8
Cessna 560 Citation XLS	PW530	2.5	0.1	2.5	0.3	5.4
Cessna 750 Citation X	6AL022	7.4	0.6	7.4	0.7	16.1
Cessna CitationJet CJ/CJ1 (Cessna 525)	1PW035	2.6	0.1	2.5	0.2	5.4
Cessna CitationJet CJ2 (Cessna 525A)	1PW036	0.8	0.0	0.7	0.1	1.6
Cessna CitationJet CJ3 (Cessna 525B)	1PW038	0.8	0.0	0.7	0.1	1.6
Dassault Falcon 2000	03P14PW194	7.1	0.3	6.9	0.6	14.9
Dassault Falcon 50	1AS002	3.3	0.2	3.2	0.3	7.0
Dassault Falcon 900	1AS002	0.8	0.0	0.7	0.1	1.6
Dornier 328 Jet	7PW078	2.5	0.1	2.5	0.3	5.4
Embraer Phenom 300 (EMB-505)	PW530	10.2	0.7	9.9	0.7	21.5
Gulfstream G150	1AS002	0.8	0.0	0.7	0.1	1.6
Gulfstream G200	TFE731	0.8	0.0	0.7	0.1	1.6
Gulfstream G280	01P11HN012	1.5	0.1	1.5	0.1	3.2
Gulfstream G-5 Gulfstream 5 / G-5SP Gulfstream G500	3BR001	0.8	0.0	0.7	0.1	1.6
Gulfstream G650	01P11BR016	0.8	0.0	0.7	0.1	1.6
Raytheon Hawker 800	1AS002	2.6	0.1	2.5	0.2	5.4
Subtotal		*69.5*	*3.5*	*64.1*	*5.7*	*139.3*
Helicopters						
Agusta A119	250B17	0.2	0.0	0.1	0.0	0.3
Bell 407 / Rolls-Royce 250-C47B	250B17	0.2	0.0	0.2	0.0	0.4
Eurocopter EC-130	TPE3	0.8	0.3	0.8	0.4	2.3
Subtotal		*1.2*	*0.3*	*1.1*	*0.4*	*3.0*
Military						
Boeing C17A	F1171	3.7	0.0	3.7	0.0	7.4
Subtotal		*3.7*	*0.0*	*3.7*	*0.0*	*7.4*
Grand Total		**811.2**	**65.2**	**778.6**	**97.8**	**1,752.8**

Notes: Day = 7:00 a.m. to 9:59 p.m., Night = 10:00 p.m. to 6:59 a.m.
Totals may not equal sum due to rounding.

Source: OAG, Landing Fee Reports, FAA Operations Network (OPSNET) data, CLT Flight Tracking System Data, Landrum & Brown, 2022.

C.6.3 Runway End Utilization

The percent use of each runway end for the Future (2028) Baseline was based on a review of simulation modeling results that was prepared to determine typical usage of the parallel runways under the Future

(2028) Baseline runway layout. Adjustments were made to convert simulated conditions representing a peak day to average-annual conditions based on the historic ratio of north flow and south flow as well as other variable operating conditions. **Table C-11, Average Annual Day Runway Use – Future (2028) Baseline** summarizes the percentage of use by each aircraft category on each of the runways at CLT during the daytime (7:00 a.m. – 9:59 p.m.) and nighttime (10:00 p.m. – 6:59 a.m.) for the Future (2028) Baseline.

C.6.4 Flight Tracks

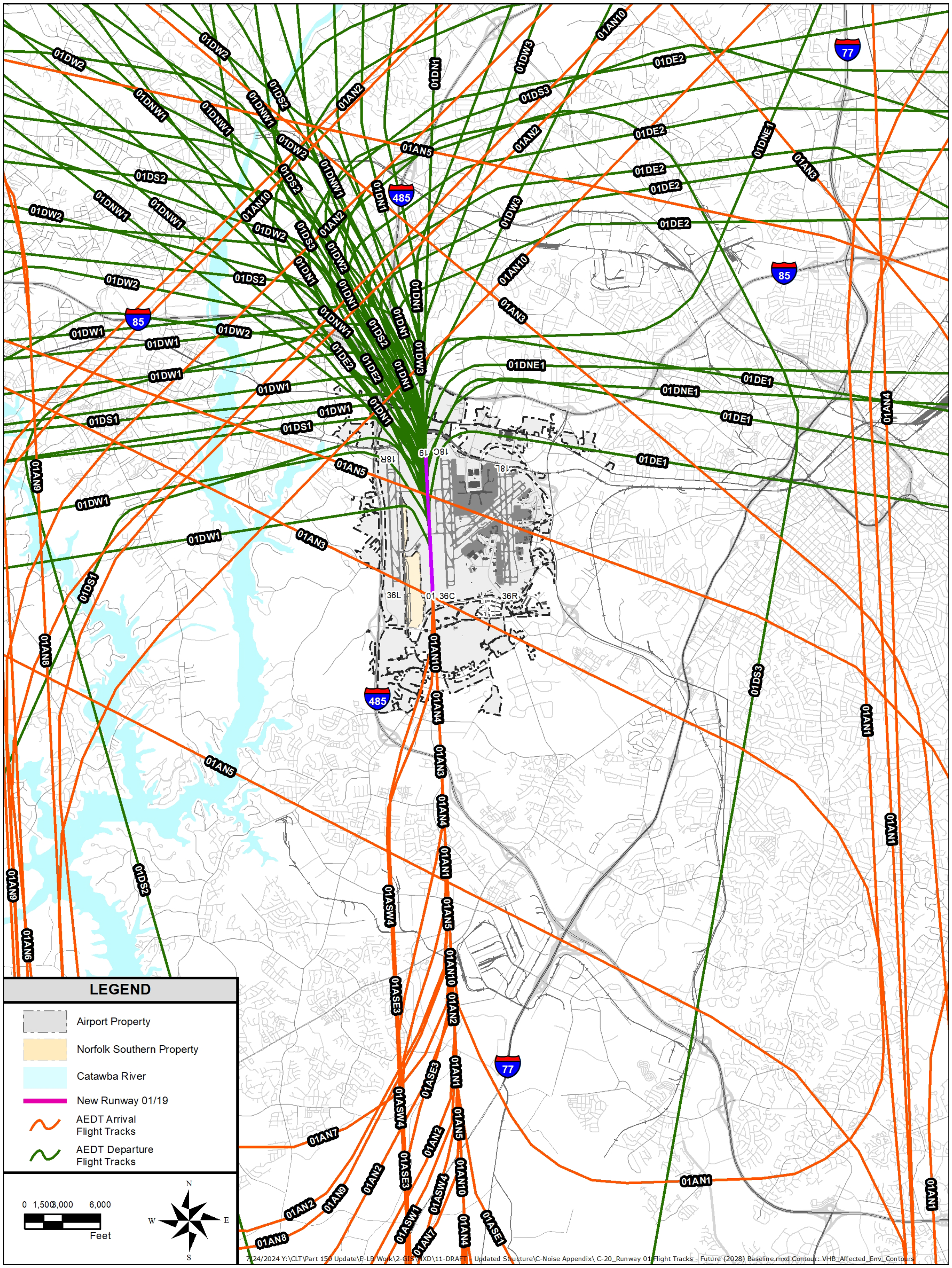
The AEDT flight tracks modeled for Runway 1/19 for the Future (2028) Baseline noise exposure contour are shown on **Exhibit C-20, *Runway 01 Flight Tracks –Future (2028) Baseline*** and **Exhibit C-21, *Runway 19 Flight Tracks – Future (2028) Baseline***. Flight tracks modeled for the other runways and helicopters remain the same as those modeled for the Existing (2023) Baseline condition shown in Exhibits C-11 through C-17. **Table C-12, *Arrival Flight Track Distribution – Future (2028) Baseline*** shows arrival flight track utilization percentages and **Table C-13, *Departure Flight Track Distribution – Future (2028) Baseline*** shows departure flight track utilization percentages for the Future (2028) Baseline. **Table C-14, *Helicopter Arrival Flight Track Distribution – Future (2028) Baseline*** shows helicopter arrival flight track utilization percentages and **Table C-15, *Helicopter Departure Flight Track Distribution – Future (2028) Baseline*** shows helicopter departure flight track utilization percentages for the Future (2028) Baseline condition. Each flight track is identified by a track ID that corresponds to the label in the flight track exhibits.

Table C-11 Average Annual Day Runway Use – Future (2028) Baseline

Aircraft Category	18C	18L	18R	36C	36L	36R	19	01	Total
Daytime Arrivals									
Heavy Passenger Jet	18.9%	12.4%	3.0%	28.2%	3.2%	31.3%	1.5%	1.5%	100.0%
Cargo Jet	6.1%	1.3%	26.9%	7.0%	51.3%	4.4%	1.5%	1.5%	100.0%
Large Passenger Jet	12.6%	4.4%	17.3%	24.0%	29.4%	9.3%	1.5%	1.5%	100.0%
Regional / GA Jet	6.3%	19.0%	9.1%	10.7%	18.4%	33.5%	1.5%	1.5%	100.0%
Commuter / Cargo / GA Prop	5.2%	28.6%	2.0%	0.0%	13.0%	51.2%	0.0%	0.0%	100.0%
Military	2.0%	33.8%	0.0%	2.0%	0.0%	62.2%	0.0%	0.0%	100.0%
Nighttime Arrivals									
Heavy Passenger Jet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cargo Jet	18.1%	17.3%	1.4%	30.7%	5.0%	26.5%	0.5%	0.5%	100.0%
Large Passenger Jet	16.5%	12.7%	6.7%	31.8%	10.9%	18.4%	1.5%	1.5%	100.0%
Regional / GA Jet	10.1%	23.1%	3.9%	19.6%	5.3%	35.0%	1.5%	1.5%	100.0%
Commuter / Cargo / GA Prop	9.3%	31.2%	0.0%	14.9%	0.7%	40.9%	1.5%	1.5%	100.0%
Military	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Daytime Departures									
Heavy Passenger Jet	0.5%	10.0%	0.0%	0.5%	0.0%	20.0%	25.3%	43.7%	100.0%
Cargo Jet	0.5%	1.0%	0.0%	0.5%	0.0%	6.0%	34.3%	57.7%	100.0%
Large Passenger Jet	0.5%	18.5%	0.0%	0.5%	0.0%	33.2%	16.8%	30.5%	100.0%
Regional / GA Jet	0.6%	16.9%	0.0%	0.6%	0.0%	30.4%	18.3%	33.2%	100.0%
Commuter / Cargo / GA Prop	0.0%	35.8%	0.0%	0.0%	0.0%	64.2%	0.0%	0.0%	100.0%
Military	2.0%	33.8%	0.0%	2.0%	0.0%	62.2%	0.0%	0.0%	100.0%
Nighttime Departures									
Heavy Passenger Jet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cargo Jet	26.1%	11.6%	0.0%	37.0%	0.0%	24.3%	0.5%	0.5%	100.0%
Large Passenger Jet	18.2%	22.0%	0.0%	29.2%	0.0%	27.6%	1.5%	1.5%	100.0%
Regional / GA Jet	14.7%	25.3%	0.0%	27.9%	0.0%	29.1%	1.5%	1.5%	100.0%
Commuter / Cargo / GA Prop	6.2%	33.7%	0.0%	16.7%	0.0%	40.4%	1.5%	1.5%	100.0%
Military	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

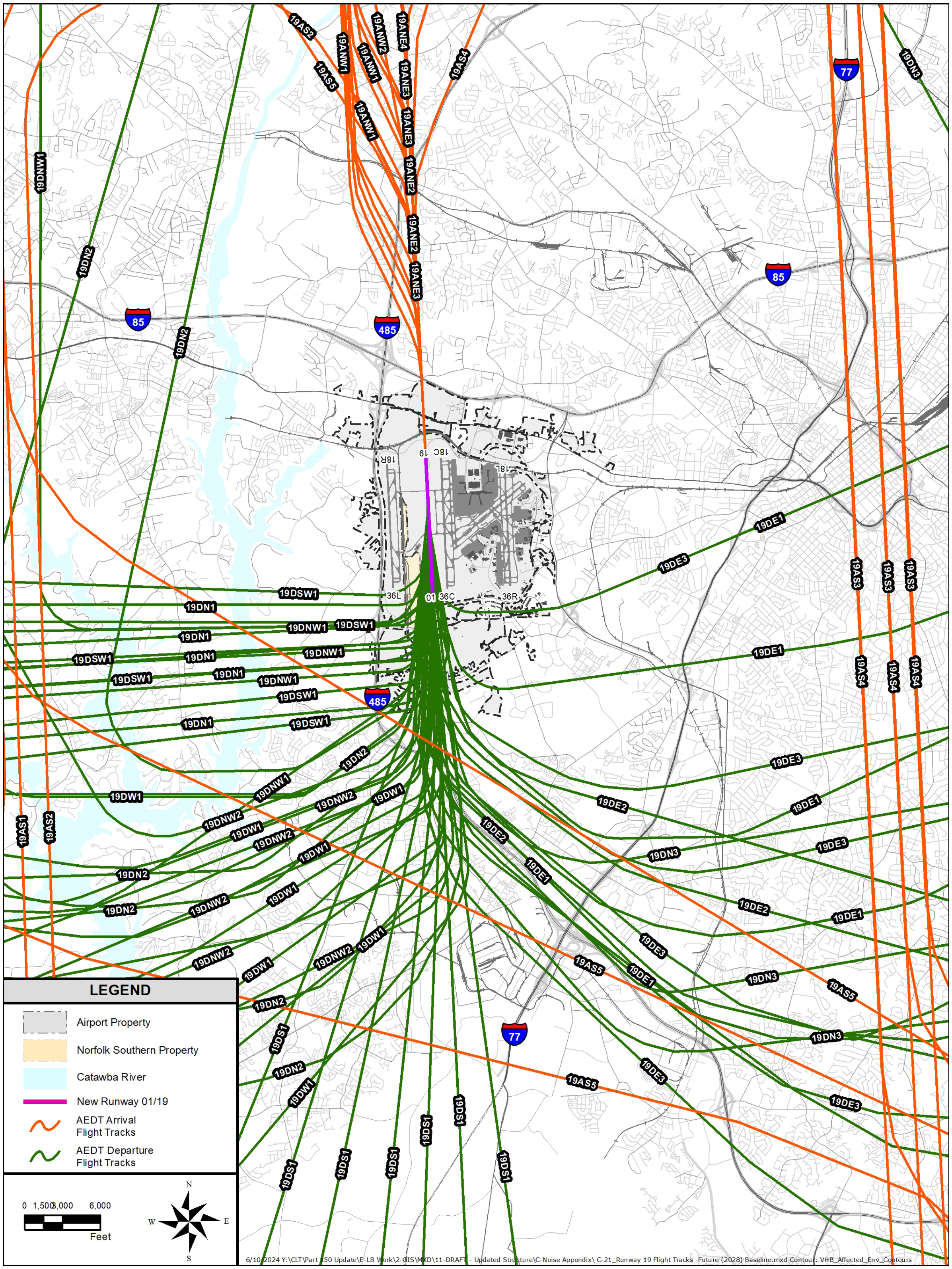
Note: Totals may not equal sums due to rounding.
Source: CLT Flight Tracking System Data, Landrum & Brown analysis, 2022.

Exhibit C-20 Runway 01 Flight Tracks –Future (2028) Baseline



Source: Landrum & Brown, 2022

Exhibit C-21 Runway 19 Flight Tracks – Future (2028) Baseline



Source: Landrum & Brown, 2022

Table C-12 Arrival Flight Track Distribution – Future (2028) Baseline

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
18L	18LAN1	0.3%	3.4%	0.3%	0.1%	0.8%	0.0%
	18LANE1	0.0%	1.0%	0.0%	0.1%	0.6%	0.0%
	18LANE2	0.0%	1.4%	0.0%	0.1%	0.5%	0.0%
	18LANE3	22.8%	14.0%	22.8%	30.0%	34.4%	29.2%
	18LANE4	19.6%	18.5%	19.6%	10.4%	21.2%	8.6%
	18LANE5	1.3%	3.3%	1.3%	3.8%	7.0%	3.2%
	18LANE6	3.2%	2.8%	3.2%	0.1%	0.7%	0.0%
	18LANW1	0.3%	3.2%	0.3%	0.1%	1.0%	0.0%
	18LANW2	1.0%	5.6%	1.0%	0.2%	1.3%	0.0%
	18LANW3	0.1%	0.7%	0.1%	4.8%	2.4%	5.2%
	18LAS1	2.4%	4.5%	2.4%	4.9%	3.2%	5.2%
	18LAS2	0.9%	3.4%	0.9%	2.8%	1.7%	3.0%
	18LAS3	2.5%	2.1%	2.5%	4.0%	2.0%	4.3%
	18LAS4	21.6%	9.2%	21.6%	1.8%	1.4%	1.9%
	18LAS5	16.8%	13.5%	16.8%	7.8%	5.8%	8.1%
	18LASE1	0.8%	0.1%	0.8%	3.0%	1.5%	3.2%
	18LASE2	0.1%	0.9%	0.1%	0.0%	0.0%	0.0%
	18LASE3	0.0%	0.1%	0.0%	0.0%	0.3%	0.0%
	18LASW1	0.6%	0.6%	0.6%	0.0%	0.3%	0.0%
	18LASW2	0.0%	0.4%	0.0%	1.1%	0.8%	1.1%
	18LAW1	5.8%	9.1%	5.8%	24.8%	13.2%	26.8%
	18LAW2	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%
	18LAW3	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%
18L Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
18C	18CANE1	0.4%	0.1%	0.4%	0.0%	0.0%	0.0%
	18CANE2	0.8%	0.1%	0.8%	0.1%	0.1%	0.1%
	18CANE3	13.6%	5.0%	13.6%	1.9%	6.8%	1.1%
	18CANE4	7.6%	4.0%	7.6%	0.9%	2.0%	0.7%
	18CANW1	1.1%	1.3%	1.1%	0.1%	0.3%	0.1%
	18CANW2	1.2%	1.0%	1.2%	0.1%	0.2%	0.0%
	18CANW3	7.1%	9.1%	7.1%	0.4%	1.6%	0.2%
	18CANW4	0.6%	1.1%	0.6%	0.0%	0.2%	0.0%
	18CANW5	15.3%	23.6%	15.3%	1.8%	5.3%	1.2%
	18CAS1	2.3%	6.3%	2.3%	0.1%	1.0%	0.0%
	18CAS2	13.7%	14.5%	13.7%	9.3%	7.7%	9.5%
	18CAS3	0.2%	0.2%	0.2%	1.4%	0.8%	1.5%
	18CAS4	3.0%	1.1%	3.0%	0.1%	0.6%	0.0%
	18CAS5	0.7%	0.3%	0.7%	2.2%	1.2%	2.4%
	18CASW1	2.2%	0.2%	2.2%	6.6%	3.6%	7.1%
	18CAW1	2.5%	4.1%	2.5%	20.1%	13.5%	21.2%
	18CAW2	2.5%	3.1%	2.5%	11.4%	8.9%	11.8%
	18CAW3	25.1%	25.0%	25.1%	43.5%	46.2%	43.0%
18C Subtotal		18.9%	10.6%	12.9%	6.4%	5.6%	2.0%

Table C-12 Arrival Flight Track Distribution – Future (2028) Baseline *(Continued)*

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
18R	18RANE1	2.3%	1.8%	2.3%	0.0%	0.0%	0.0%
	18RANE2	1.0%	1.2%	1.0%	0.0%	0.0%	0.0%
	18RANE3	7.6%	6.9%	7.6%	0.0%	0.1%	0.0%
	18RANW1	7.3%	13.4%	7.3%	1.2%	7.9%	0.0%
	18RANW2	1.1%	1.4%	1.1%	0.2%	1.0%	0.0%
	18RANW3	8.2%	12.7%	8.2%	1.2%	8.1%	0.0%
	18RANW4	0.3%	0.3%	0.3%	0.8%	0.7%	0.0%
	18RAS1	2.2%	0.9%	2.2%	1.4%	2.0%	0.0%
	18RAS2	0.1%	0.0%	0.1%	0.2%	0.1%	0.0%
	18RAS3	34.3%	18.9%	34.3%	50.2%	48.4%	0.0%
	18RAS4	3.7%	1.7%	3.7%	2.2%	3.3%	0.0%
	18RAW1	6.0%	8.7%	6.0%	10.6%	11.8%	0.0%
	18RAW2	0.2%	0.4%	0.2%	0.5%	0.6%	0.0%
	18RAW3	25.8%	31.7%	25.8%	31.4%	16.0%	0.0%
18R Subtotal		3.0%	17.4%	16.5%	8.8%	1.8%	0.0%
36C	36CAN1	13.0%	6.1%	13.0%	0.3%	1.4%	0.1%
	36CAN10	0.3%	0.2%	0.3%	0.0%	0.0%	0.0%
	36CAN2	0.4%	0.0%	0.4%	0.0%	0.0%	0.0%
	36CAN3	0.7%	0.7%	0.7%	0.0%	0.1%	0.0%
	36CAN4	1.1%	1.4%	1.1%	7.7%	4.0%	8.4%
	36CAN5	0.0%	1.5%	0.0%	0.0%	0.2%	0.0%
	36CAN6	0.5%	1.4%	0.5%	0.1%	0.6%	0.0%
	36CAN7	3.9%	0.5%	3.9%	0.3%	2.1%	0.0%
	36CAN8	26.6%	26.7%	26.6%	3.5%	22.2%	0.3%
	36CAN9	14.3%	14.3%	14.3%	1.7%	11.9%	0.0%
	36CASE1	3.7%	5.1%	3.7%	0.6%	3.9%	0.0%
	36CASE2	5.7%	15.0%	5.7%	1.3%	8.8%	0.1%
	36CASE3	0.4%	0.5%	0.4%	1.5%	0.8%	1.6%
	36CASW1	11.6%	3.4%	11.6%	4.6%	2.6%	4.9%
	36CASW2	7.1%	17.4%	7.1%	41.7%	22.9%	44.8%
	36CASW3	6.0%	2.1%	6.0%	24.7%	12.5%	26.8%
	36CASW4	1.1%	0.7%	1.1%	4.4%	2.2%	4.8%
	36CASW5	3.7%	3.0%	3.7%	7.4%	3.9%	8.0%
36C Subtotal		28.2%	15.9%	24.6%	11.2%	1.4%	2.0%

Table C-12 Arrival Flight Track Distribution – Future (2028) Baseline *(Continued)*

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
36L	36LANE1	2.5%	3.7%	2.5%	49.7%	24.7%	0.0%
	36LANE2	2.0%	1.7%	2.0%	0.3%	0.1%	0.0%
	36LANE3	0.3%	0.3%	0.3%	0.0%	0.0%	0.0%
	36LANE4	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%
	36LANW1	12.7%	31.0%	12.7%	2.6%	1.4%	0.0%
	36LANW2	0.1%	0.2%	0.1%	0.0%	0.0%	0.0%
	36LANW3	38.3%	31.2%	38.3%	14.7%	7.4%	0.0%
	36LASE1	6.1%	2.3%	6.1%	0.6%	0.3%	0.0%
	36LASE2	1.9%	0.4%	1.9%	0.2%	0.1%	0.0%
	36LASE3	3.6%	1.5%	3.6%	0.4%	0.2%	0.0%
	36LASW1	5.1%	5.3%	5.1%	0.7%	0.4%	0.0%
	36LASW2	12.5%	11.5%	12.5%	8.8%	7.3%	0.0%
	36LASW3	14.9%	10.9%	14.9%	21.9%	57.9%	0.0%
36L Subtotal		3.2%	34.0%	28.0%	17.7%	11.8%	0.0%
36R	36RAE1	0.1%	0.4%	0.1%	0.2%	0.4%	0.2%
	36RANE1	4.7%	4.5%	4.7%	2.5%	4.5%	2.1%
	36RANE2	27.8%	20.2%	27.8%	7.2%	17.7%	5.4%
	36RANE3	38.6%	23.1%	38.6%	10.5%	23.1%	8.3%
	36RANE4	0.1%	0.8%	0.1%	0.1%	0.5%	0.0%
	36RANW1	3.3%	3.5%	3.3%	2.0%	3.9%	1.7%
	36RANW2	0.3%	2.3%	0.3%	6.7%	4.8%	7.0%
	36RANW3	0.9%	0.5%	0.9%	1.1%	0.9%	1.2%
	36RANW4	0.7%	2.0%	0.7%	6.2%	3.1%	6.7%
	36RANW5	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%
	36RANW6	3.8%	7.0%	3.8%	12.5%	7.6%	13.3%
	36RAS1	0.5%	1.0%	0.5%	0.5%	0.5%	0.5%
	36RASE1	12.2%	17.0%	12.2%	25.6%	15.3%	27.3%
	36RASE2	5.5%	10.5%	5.5%	15.3%	9.4%	16.3%
	36RASW1	1.2%	4.1%	1.2%	9.1%	5.8%	9.7%
	36RASW2	0.2%	2.2%	0.2%	0.5%	2.1%	0.2%
	36RAW1	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%
	36RAW2	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%
36R Subtotal		31.3%	12.7%	10.0%	33.6%	50.2%	62.2%

Table C-12 Arrival Flight Track Distribution – Future (2028) Baseline *(Continued)*

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
01	01AN1	13.0%	6.1%	13.0%	0.3%	1.4%	0.0%
	01AN10	0.3%	0.2%	0.3%	0.0%	0.0%	0.0%
	01AN2	0.4%	0.0%	0.4%	0.0%	0.0%	0.0%
	01AN3	0.7%	0.7%	0.7%	0.0%	0.1%	0.0%
	01AN4	1.1%	1.4%	1.1%	7.7%	4.0%	0.0%
	01AN5	0.0%	1.5%	0.0%	0.0%	0.2%	0.0%
	01AN6	0.5%	1.4%	0.5%	0.1%	0.6%	0.0%
	01AN7	3.9%	0.5%	3.9%	0.3%	2.1%	0.0%
	01AN8	26.6%	26.7%	26.6%	3.5%	22.2%	0.0%
	01AN9	14.3%	14.3%	14.3%	1.7%	11.9%	0.0%
	01ASE1	3.7%	5.1%	3.7%	0.6%	3.9%	0.0%
	01ASE2	5.7%	15.0%	5.7%	1.3%	8.8%	0.0%
	01ASE3	0.4%	0.5%	0.4%	1.5%	0.8%	0.0%
	01ASW1	11.6%	3.4%	11.6%	4.6%	2.6%	0.0%
	01ASW2	7.1%	17.4%	7.1%	41.7%	22.9%	0.0%
	01ASW3	6.0%	2.1%	6.0%	24.7%	12.5%	0.0%
	01ASW4	1.1%	0.7%	1.1%	4.4%	2.2%	0.0%
	01ASW5	3.7%	3.0%	3.7%	7.4%	3.9%	0.0%
01 Subtotal		1.5%	1.1%	1.5%	1.5%	0.1%	0.0%
19	19ANE1	0.4%	0.1%	0.4%	0.0%	0.0%	0.0%
	19ANE2	0.8%	0.1%	0.8%	0.1%	0.1%	0.0%
	19ANE3	13.6%	5.0%	13.6%	1.9%	6.8%	0.0%
	19ANE4	7.6%	4.0%	7.6%	0.9%	2.0%	0.0%
	19ANW1	1.1%	1.3%	1.1%	0.1%	0.3%	0.0%
	19ANW2	1.2%	1.0%	1.2%	0.1%	0.2%	0.0%
	19ANW3	7.1%	9.1%	7.1%	0.4%	1.6%	0.0%
	19ANW4	0.6%	1.1%	0.6%	0.0%	0.2%	0.0%
	19ANW5	15.3%	23.6%	15.3%	1.8%	5.3%	0.0%
	19AS1	2.3%	6.3%	2.3%	0.1%	1.0%	0.0%
	19AS2	13.7%	14.5%	13.7%	9.3%	7.7%	0.0%
	19AS3	0.2%	0.2%	0.2%	1.4%	0.8%	0.0%
	19AS4	3.0%	1.1%	3.0%	0.1%	0.6%	0.0%
	19AS5	0.7%	0.3%	0.7%	2.2%	1.2%	0.0%
	19ASW1	2.2%	0.2%	2.2%	6.6%	3.6%	0.0%
	19AW1	2.5%	4.1%	2.5%	20.1%	13.5%	0.0%
	19AW2	2.5%	3.1%	2.5%	11.4%	8.9%	0.0%
	19AW3	25.1%	25.0%	25.1%	43.5%	46.2%	0.0%
19 Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	0.0%

Note: Totals may not equal sum due to rounding.
Source: Landrum & Brown, 2024

Table C-13 Departure Flight Track Distribution – Future (2028) Baseline

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
18L	18LDE1	0.2%	3.3%	0.2%	0.8%	5.5%	33.3%
	18LDE2	39.6%	30.6%	39.6%	45.6%	47.1%	5.6%
	18LDE3	4.2%	4.9%	4.2%	21.9%	14.3%	0.0%
	18LDE4	1.0%	2.3%	1.0%	7.5%	4.9%	0.0%
	18LDE5	0.8%	0.5%	0.8%	3.5%	2.2%	0.0%
	18LDN1	0.0%	1.1%	0.0%	1.0%	3.8%	0.0%
	18LDN2	0.9%	3.1%	0.9%	1.9%	1.1%	0.0%
	18LDN3	0.0%	0.2%	0.0%	0.1%	0.5%	0.0%
	18LDN4	7.2%	9.1%	7.2%	1.4%	2.4%	0.0%
	18LDN5	0.9%	0.8%	0.9%	0.0%	0.1%	0.0%
	18LDNW1	2.8%	3.8%	2.8%	4.7%	4.7%	0.0%
	18LDS1	40.8%	22.6%	40.8%	4.8%	5.6%	27.8%
	18LDW1	0.0%	2.8%	0.0%	0.3%	2.1%	33.3%
	18LDW2	1.0%	7.6%	1.0%	5.7%	3.9%	0.0%
	18LDW3	0.5%	7.0%	0.5%	0.7%	1.7%	0.0%
18L Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
18C	18CDE1	0.7%	1.3%	0.7%	0.0%	0.0%	0.0%
	18CDE2	0.2%	0.2%	0.2%	0.0%	0.0%	0.0%
	18CDE3	1.8%	1.4%	1.8%	0.0%	0.0%	0.0%
	18CDN1	0.1%	2.0%	0.1%	0.1%	0.4%	0.0%
	18CDN2	17.4%	20.5%	17.4%	15.8%	8.1%	0.0%
	18CDN3	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
	18CDNW1	0.2%	0.2%	0.2%	0.0%	0.0%	0.0%
	18CDNW2	16.7%	22.7%	16.7%	5.0%	14.8%	0.0%
	18CDS1	6.0%	2.6%	6.0%	0.4%	3.0%	6.4%
	18CDSW1	0.4%	0.2%	0.4%	0.2%	1.7%	3.3%
	18CDW1	56.3%	48.7%	56.3%	78.4%	71.9%	90.3%
18C Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
36C	36CDE1	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%
	36CDE2	3.0%	3.4%	3.0%	2.6%	1.3%	0.0%
	36CDN1	17.1%	24.0%	17.1%	47.2%	23.9%	0.0%
	36CDNE1	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
	36CDNW1	14.8%	19.5%	14.8%	32.8%	27.6%	0.0%
	36CDS1	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%
	36CDS2	11.2%	6.4%	11.2%	10.0%	11.0%	0.0%
	36CDS3	0.1%	0.1%	0.1%	0.0%	0.1%	0.0%
	36CDW1	0.4%	0.8%	0.4%	1.0%	3.6%	66.7%
	36CDW2	53.3%	45.4%	53.3%	6.4%	32.4%	33.3%
	36CDW3	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
36C Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table C-13 Departure Flight Track Distribution – Future (2028) Baseline *(Continued)*

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
36R	36RDE1	0.2%	5.1%	0.2%	12.0%	9.0%	20.0%
	36RDE2	51.9%	38.6%	51.9%	6.7%	14.1%	40.0%
	36RDE3	22.1%	19.1%	22.1%	4.1%	6.9%	0.0%
	36RDN1	0.9%	2.2%	0.9%	4.2%	8.7%	0.0%
	36RDN2	0.7%	3.4%	0.7%	6.6%	6.4%	0.0%
	36RDN3	0.1%	0.2%	0.1%	0.5%	0.2%	0.0%
	36RDNE1	0.0%	0.5%	0.0%	1.4%	0.7%	0.0%
	36RDNE2	0.2%	0.9%	0.2%	2.0%	1.4%	0.0%
	36RDNE3	0.0%	0.3%	0.0%	1.7%	2.4%	0.0%
	36RDNW1	1.0%	2.4%	1.0%	15.1%	13.7%	0.0%
	36RDS1	0.4%	0.9%	0.4%	10.8%	6.9%	40.0%
	36RDSE1	0.0%	0.6%	0.0%	2.3%	1.2%	0.0%
	36RDSE2	9.5%	18.8%	9.5%	12.7%	7.5%	0.0%
	36RDSW1	0.1%	1.5%	0.1%	0.9%	2.0%	0.0%
	36RDSW2	1.5%	1.1%	1.5%	2.9%	3.4%	0.0%
	36RDSW3	8.9%	1.7%	8.9%	2.7%	1.4%	0.0%
	36RDW1	0.2%	1.1%	0.2%	5.7%	4.3%	0.0%
	36RDW2	2.4%	1.7%	2.4%	7.6%	10.0%	0.0%
36R Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
01	01DE1	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%
	01DE2	3.0%	3.4%	3.0%	2.6%	1.3%	0.0%
	01DN1	17.1%	24.0%	17.1%	47.2%	23.9%	0.0%
	01DNE1	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
	01DNW1	14.8%	19.5%	14.8%	32.8%	27.6%	0.0%
	01DS1	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%
	01DS2	11.2%	6.4%	11.2%	10.0%	11.0%	0.0%
	01DS3	0.1%	0.1%	0.1%	0.0%	0.1%	0.0%
	01DW1	0.4%	0.8%	0.4%	1.0%	3.6%	0.0%
	01DW2	53.3%	45.4%	53.3%	6.4%	32.4%	0.0%
	01DW3	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
01 Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	0.0%
19	19DE1	0.7%	1.3%	0.7%	0.0%	0.0%	0.0%
	19DE2	0.2%	0.2%	0.2%	0.0%	0.0%	0.0%
	19DE3	1.8%	1.4%	1.8%	0.0%	0.0%	0.0%
	19DN1	0.1%	2.0%	0.1%	0.1%	0.4%	0.0%
	19DN2	17.4%	20.5%	17.4%	15.8%	8.1%	0.0%
	19DN3	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
	19DNW1	0.2%	0.2%	0.2%	0.0%	0.0%	0.0%
	19DNW2	16.7%	22.7%	16.7%	5.0%	14.8%	0.0%
	19DS1	6.0%	2.6%	6.0%	0.4%	3.0%	0.0%
	19DSW1	0.4%	0.2%	0.4%	0.2%	1.7%	0.0%
	19DW1	56.3%	48.7%	56.3%	78.4%	71.9%	0.0%
19 Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	0.0%

Note: Totals may not equal sum due to rounding.
Source: Landrum & Brown, 2024

Table C-14 Helicopter Arrival Flight Track Distribution – Future (2028) Baseline

Runway End	Track ID	Helicopter
HP-1	HA1-0	34.0%
	HA1-1	33.0%
	HA1-2	33.0%
HP-1 Subtotal		100.0%
HP-2	HA2-0	35.0%
	HA2-1	35.0%
	HA2-2	5.0%
	HA2-3	20.0%
	HA2-4	5.0%
HP-2 Subtotal		100.0%

Note: Totals may not equal sum due to rounding.
Source: Landrum & Brown, 2022

Table C-15 Helicopter Departure Flight Track Distribution – Future (2028) Baseline

Runway End	Track ID	Helicopter
HP-1	HD1-0	34.0%
	HD1-1	33.0%
	HD1-2	33.0%
HP-1 Subtotal		100.0%
HP-2	HD2-0	30.0%
	HD2-1	30.0%
	HD2-2	30.0%
	HD2-3	5.0%
	HD2-4	5.0%
HP-2 Subtotal		100.0%

Note: Totals may not equal sum due to rounding.
Source: Landrum & Brown, 2022

C.6.5 Aircraft Weight and Trip Length

The trip lengths modeled for the Future (2028) Baseline noise exposure contour are based upon a review of departure destinations from the design day schedule from the forecast of aviation activity prepared for CLT.[19] **Table C-16, *Departure Stage Length – Future (2028) Baseline*** indicates the proportion of the operations that fell within the trip length categories.

[19] Forecast Technical Memorandum, Technical Memorandum – Final, Charlotte Douglas International Airport Environmental Impact Statement, VHB in association with InterVISTAS, April 18, 2018.

Table C-16 Departure Stage Length – Future (2028) Baseline

Aircraft Category	Departure Stage Length					
	1	2	3	4	5	6
Heavy Passenger Jet	0%	0%	0%	0%	32%	68%
Cargo Jet	100%	0%	0%	0%	0%	0%
Large Passenger Jet	46%	43%	6%	5%	0%	0%
Regional / GA Jet	98%	2%	0%	0%	0%	0%
Commuter / Cargo / GA Prop	100%	0%	0%	0%	0%	0%
Military	100%	0%	0%	0%	0%	0%

Note: Totals may not equal sum due to rounding.
Source: Landrum & Brown, 2022

C.6.6 Ground Run-Up Activity

Engine run-up activity was projected for the Future (2028) Baseline based on the forecast increase in operations CLT. On average, approximately 26 run-ups are expected to occur per day at CLT in 2028. Estimates of run-up times and durations remained the same as described for the Existing (2023) conditions. It is anticipated that run-ups would only occur at run-up locations 2 through 6 in the Future (2028) conditions as listed in **Table C-17, *Aircraft Engine Run-Up Locations*** and shown in **Exhibit C-22, *Run-Up Locations – Future (2028) Baseline.***

Table C-17 Aircraft Engine Run-Up Locations[20]

Map ID	Run-Up Location Description
2	West pad of former Runway 5/23
3	Center pad of former Runway 5/23
4	Taxiway C between Taxiway C1 and C3
5	Taxiway M between Taxiway M3 and D
6	NCANG Ramp

The number, types, durations and times of day of engine run-ups estimated for the Future (2028) condition are shown in **Table C-18, *Aircraft Engine Run-Ups – Future (2028) Baseline*.**

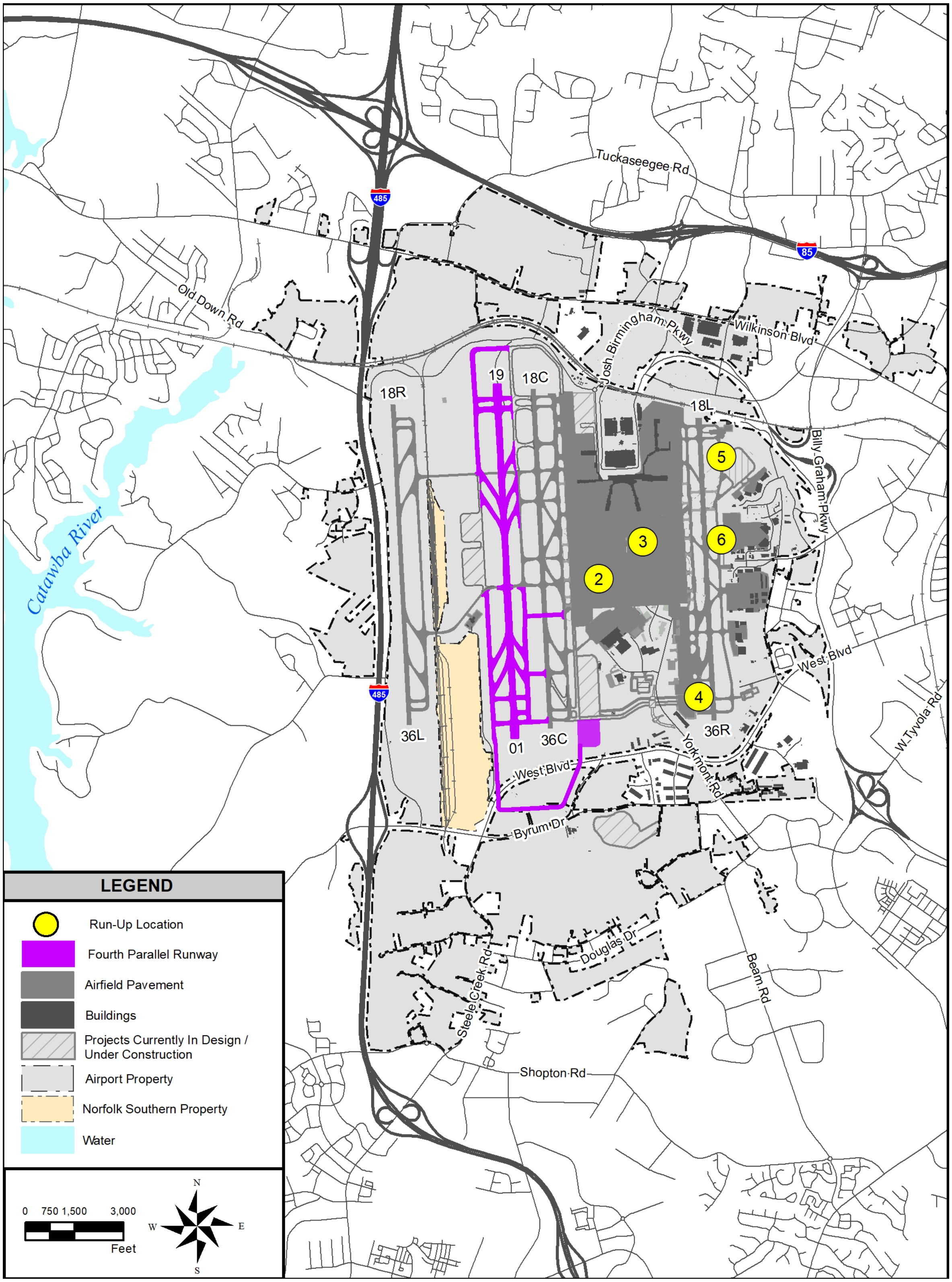
[20] Based on AO-SOP-013 (revised October 21, 2022), Taxiway E is no longer used as a run-up location

Table C-18 Aircraft Engine Run-Ups - Future (2028) Baseline

AEDT Aircraft ID	Run-Ups per Day			
	Daytime	Nighttime	Total Run-ups	Total Duration *(h:mm:ss)*
Civil Run-Ups				
Airbus A319-100 Series	1.20	0.80	2.00	0:23:03
Airbus A320-200 Series	0.68	0.45	1.13	0:12:57
Airbus A321-200 Series	2.53	1.69	4.22	0:48:32
Boeing 737-800 Series	1.75	1.17	2.92	0:33:34
Boeing 787-9 Dreamliner	0.14	0.09	0.23	0:02:39
Bombardier CRJ-900-ER	5.09	3.39	8.48	1:37:31
Embraer ERJ145-LR	2.41	1.61	4.02	0:46:12
Embraer ERJ175-LR	1.44	0.96	2.40	0:27:37
Subtotal	*15.24*	*10.16*	*25.40*	*4:52:05*
Military Run-Ups				
Boeing C-17A	0.68	0.00	0.68	0:20:30
Subtotal	*0.68*	*0.00*	*0.68*	*0:20:30*
Total	**15.92**	**10.16**	**26.08**	**5:12:35**

Source: FAA Order CLT 7110.65V, Landrum & Brown analysis, 2022.

Exhibit C-22 Run-Up Locations – Future (2028) Baseline



Source: Landrum & Brown, 2022.

C.7 Future (2028) NEM/NCP Noise Exposure Contour

The elements of the Noise Compatibility Program (NCP) described in Chapter 4 include several noise abatement measures that would change the operating conditions in respect to what was modeled for the Future (2028) Baseline noise exposure contour. The following sections describe the differences in operating conditions between the Future (2028) Baseline (future conditions without implementation of the 2024 NCP) and Future (2028) NEM/NCP (future conditions with implementation of the 2024 NCP) noise exposure contours from this Study.

C.7.1 Runway Definition

The runway layout discussed for the Future (2028) Baseline condition would remain the same for the Future (2028) NEM/NCP noise exposure contour.

C.7.2 Number of Operations and Fleet Mix

The number of annual aircraft operations and fleet mix discussed for the Future (2028) Baseline condition would remain the same for the Future (2028) NEM/NCP noise exposure contour.

C.7.3 Runway End Utilization

The percent use of each runway end for the Future (2028) NEM/NCP noise exposure contour would change compared to the Future (2028) Baseline due to the implementation of the following noise abatement measures:

- Measure NA-11 – Designate Runway 36L and 36R as preferred for north flow arrivals by turbojet aircraft between 10:00 p.m. and 7:00 a.m.
- Measure NA-12 – Designate Runways 18L, 18C, and18R for south flow arrivals by turbojet aircraft between 10:00 p.m. and 7:00 a.m.

The above-listed noise abatement measures would change nighttime (10:00 p.m. to 6:59 a.m.) arrivals only. The percentage of departures and daytime (7:00 a.m. to 9:59 p.m.) arrivals by runway end would remain the same as the Future (2028) Baseline shown in Table C-11. **Table C-19, Average Annual Day Runway Use – Future (2028) NEM/NCP** summarizes the percentage of use by each aircraft category for nighttime arrivals for the Future (2028) NEM/NCP condition.

Table C-19 Average Annual Day Runway Use – Future (2028) NEM/NCP

Aircraft Category	18C	18L	18R	36C	36L	36R	19	01	Total
Nighttime Arrivals									
Heavy Passenger Jet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cargo Jet	18.1%	17.3%	1.4%	30.7%	5.0%	26.5%	0.5%	0.5%	100.0%
Large Passenger Jet	11.5%	7.7%	16.7%	6.8%	23.4%	30.9%	1.5%	1.5%	100.0%
Regional / GA Jet	6.8%	19.8%	10.5%	13.2%	8.5%	38.2%	1.5%	1.5%	100.0%
Commuter / Cargo / GA Prop	9.3%	31.2%	0.0%	14.9%	0.7%	40.9%	1.5%	1.5%	100.0%
Military	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Note: Totals may not equal sums due to rounding.
Source: Landrum & Brown analysis, 2024.

C.7.4 Flight Tracks

The location and usage of departure flight tracks would change compared to the Future (2028) Baseline due to the implementation of the following noise abatement measures:

- Measure NA-13 – Maximize the number of divergent headings for north flow departures while maintaining a 15° separation between headings on Runway 36C, Runway 36R, and Runway 01.
- Measure NA-14 – Maximize the number of divergent headings for south flow departures while maintaining a 15° separation between headings on Runway 18C, Runway 18L, and Runway 19. This would require the elimination of the 2-mile restriction.

The above-listed noise abatement measures would change the location and percent utilization of departure flight tracks only. Arrival flight track locations would remain the same as the Future (2028) Baseline shown in Exhibits C-11 to C-15 and C-20 to C-21. Arrival flight track utilization would remain the same as the Future (2028) Baseline shown in Table C-12. New AEDT flight tracks modeled for this scenario are shown in **Exhibits C-23 through C-28**. **Table C-20, *Departure Flight Track Distribution – Future (2028) NEM/NCP***, summarizes the percentage of use by each aircraft category for nighttime arrivals for the Future (2028) NEM/NCP. The noise abatement flight corridors are expected to be utilized by commercial jet traffic. General aviation aircraft are expected to use similar flight procedures as the Existing (2023) Baseline and Future (2028) Baseline as shown in Exhibits C-11 to C-16 and Exhibit C-20 and C-21.

Helicopter flight tracks are expected to remain unchanged from what is shown in Exhibit C-17 and Tables C-14 and C-15.

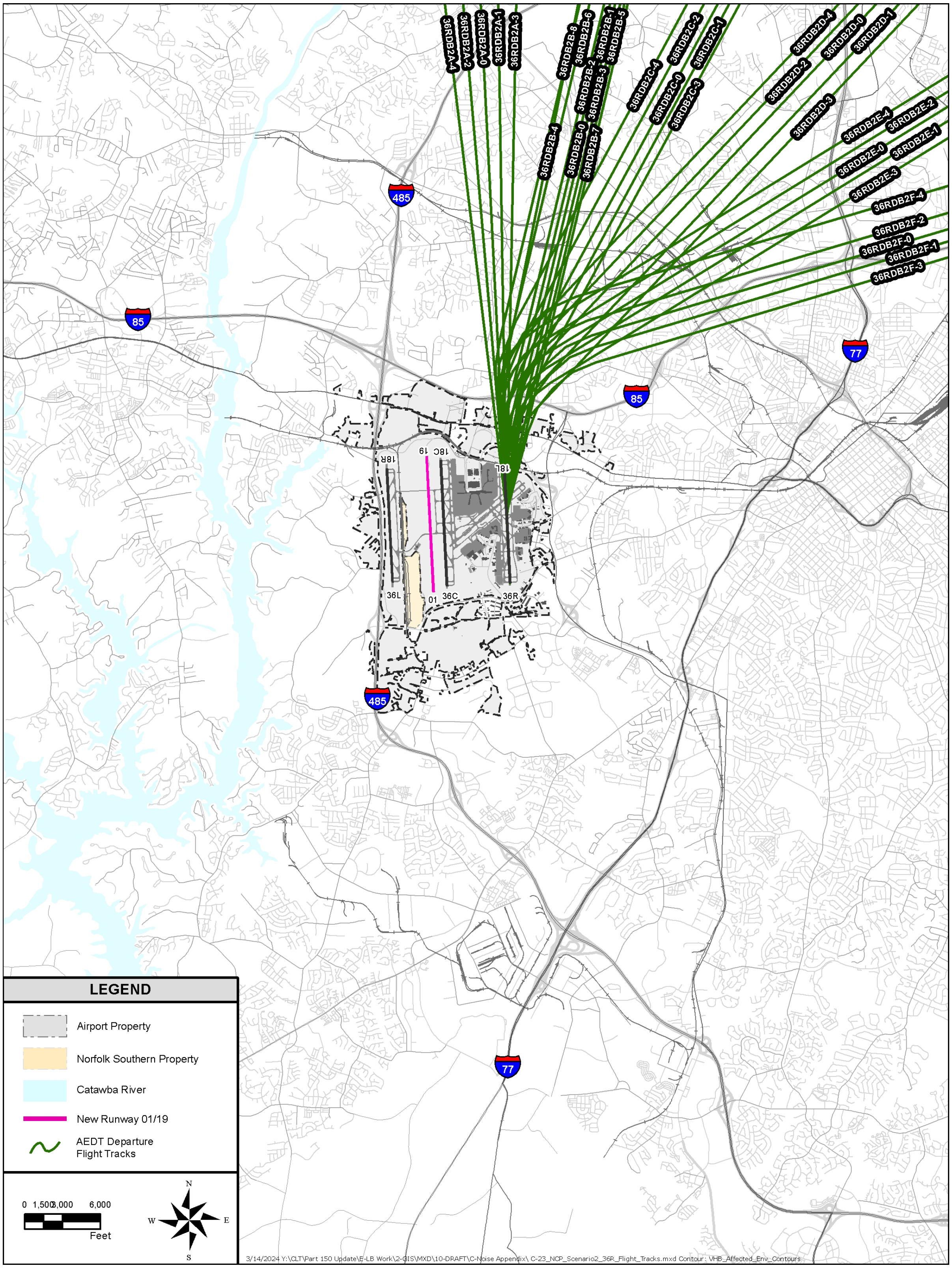
C.7.5 Aircraft Weight and Trip Length

The trip lengths would not change under the Future (2028) NEM/NCP; therefore, the stage length percentages would be the same as modeled for the Future (2028) Baseline shown in Table C-16.

C.7.6 Ground Run-Up Activity

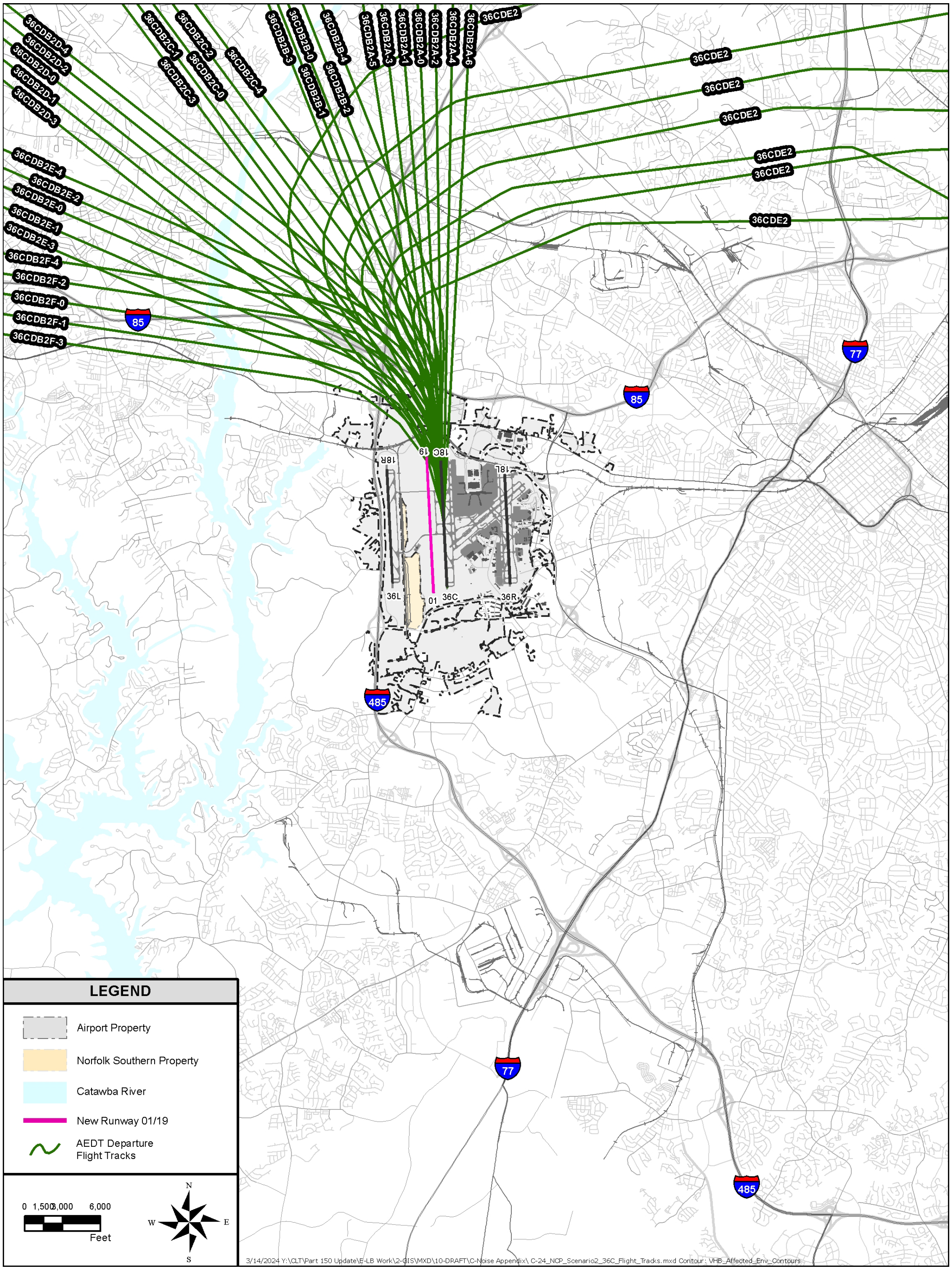
Engine run-up activity would not change under the Future (2028) NEM/NCP; therefore, the run-up locations would remain the same as presented in Exhibit C-22 Table C-17, and the number of modeled run-ups are the same as shown in Table C-18.

Exhibit C-23 Runway 36R Flight Tracks –Future (2028) NEM/NCP



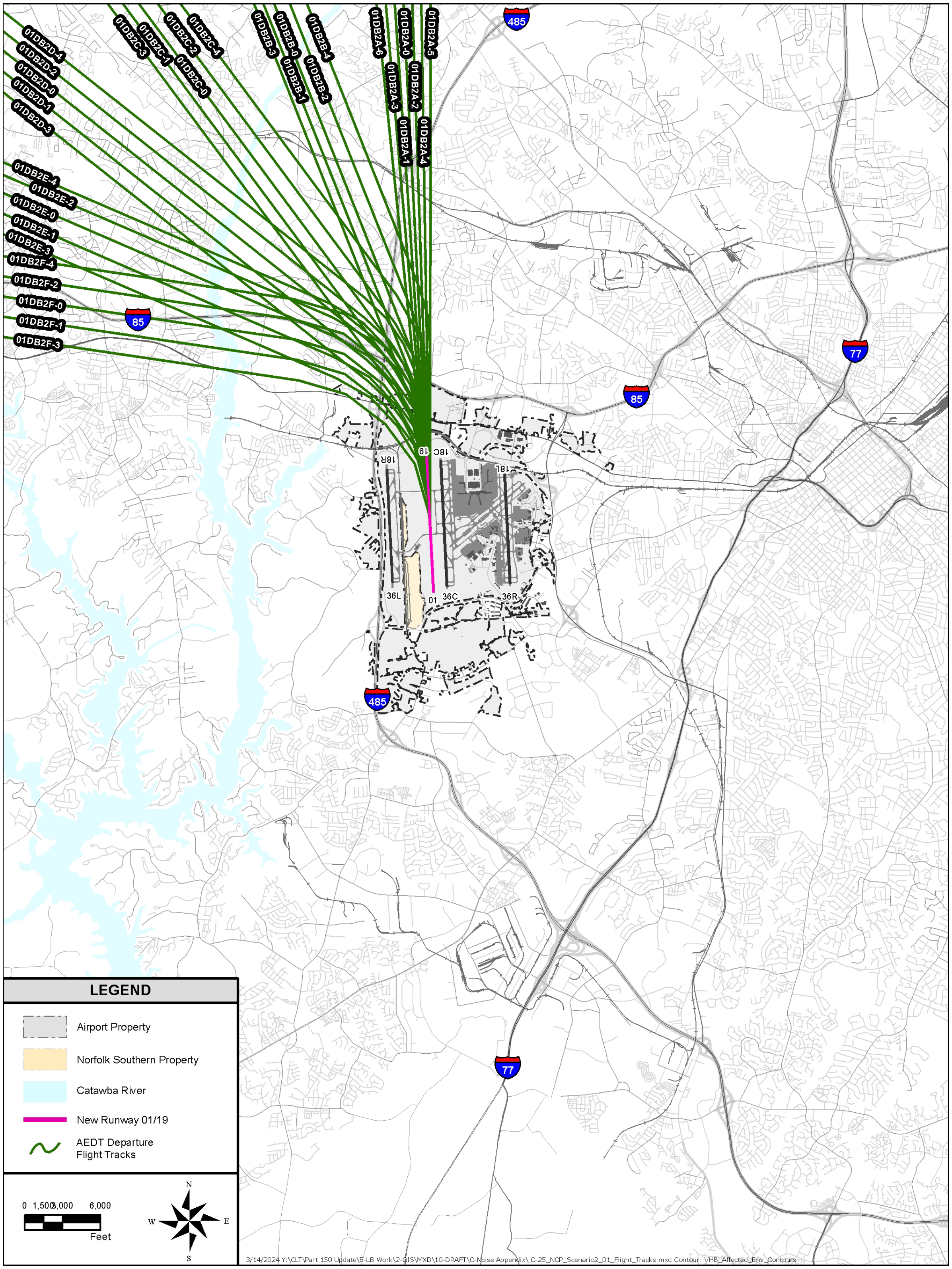
Source: Landrum & Brown, 2024

Exhibit C-24 Runway 36C Flight Tracks –Future (2028) NEM/NCP



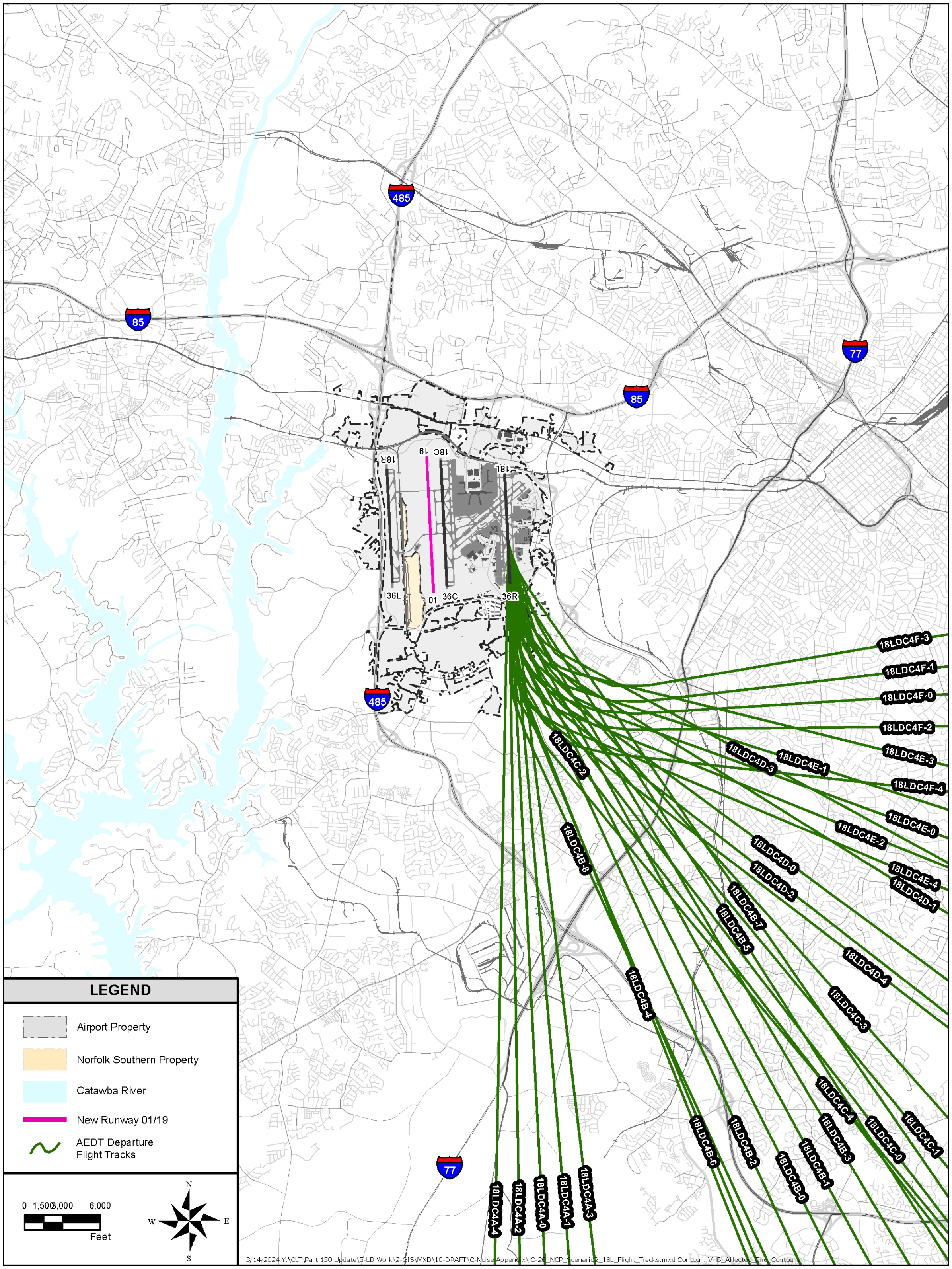
Source: Landrum & Brown, 2024

Exhibit C-25 Runway 01 Flight Tracks –Future (2028) NEM/NCP



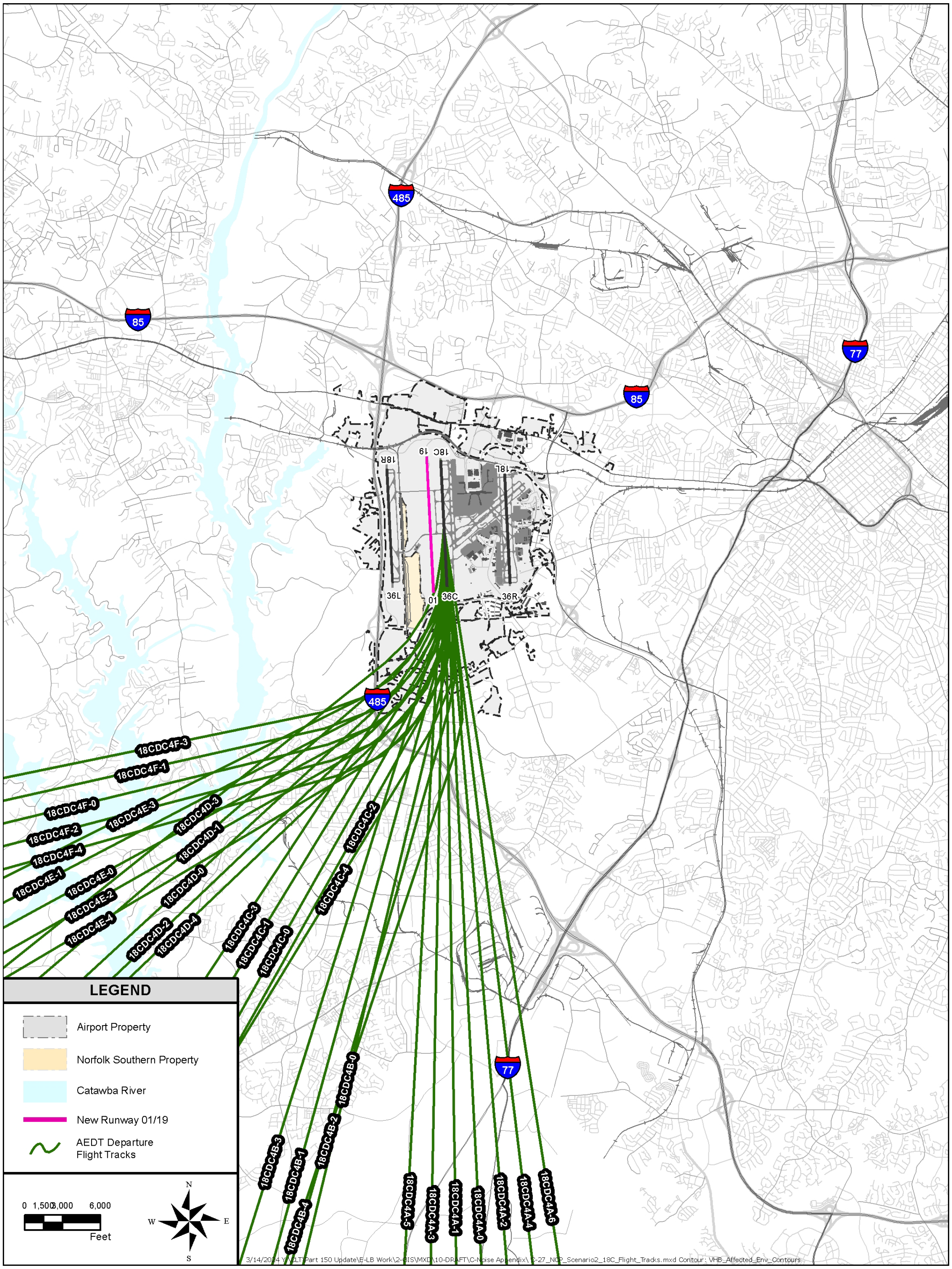
Source: Landrum & Brown, 2024

Exhibit C-26 Runway 18L Flight Tracks –Future (2028) NEM/NCP



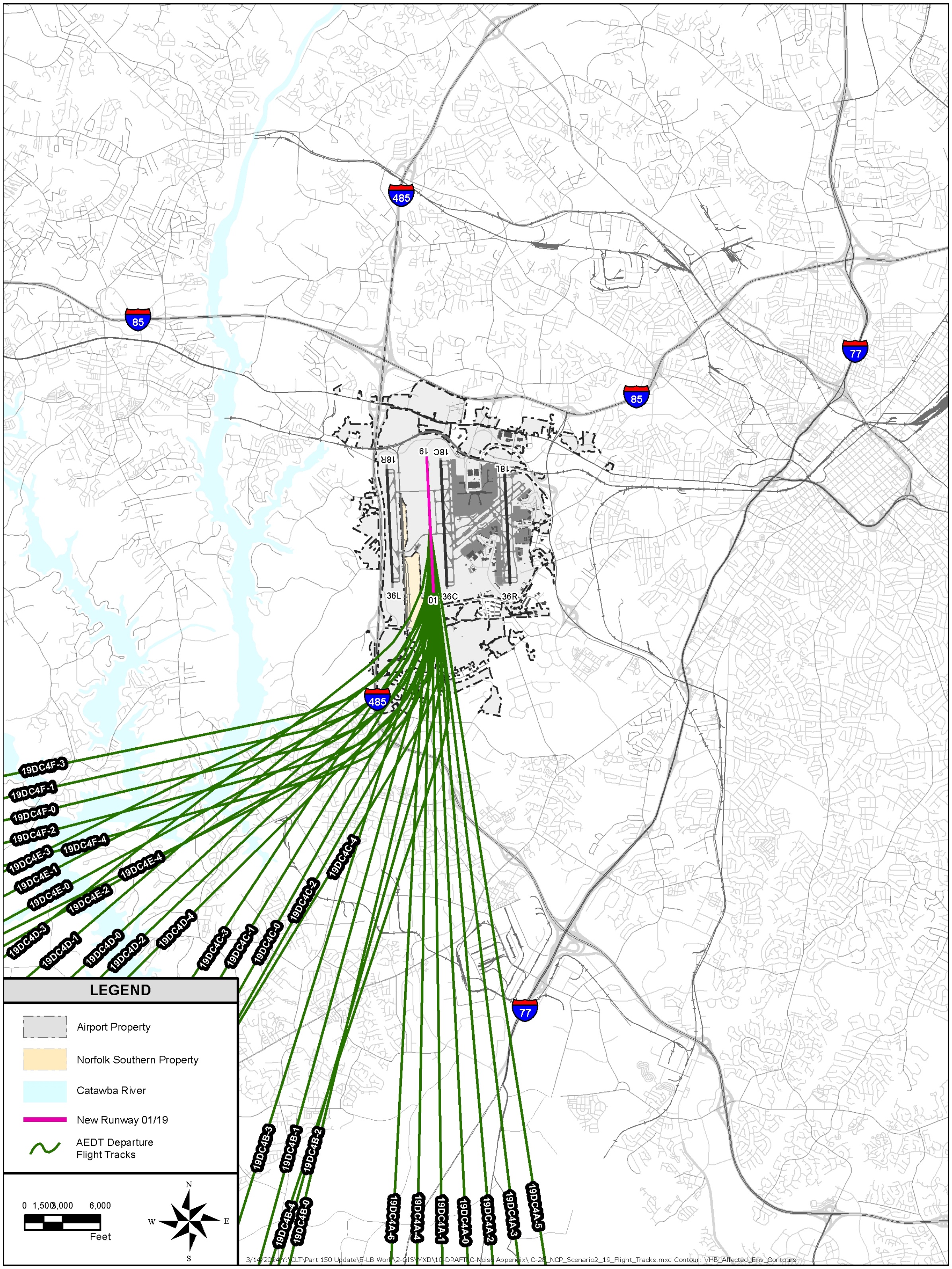
Source: Landrum & Brown, 2024

Exhibit C-27 Runway 18C Flight Tracks –Future (2028) NEM/NCP



Source: Landrum & Brown, 2024

Exhibit C-28 Runway 19 Flight Tracks –Future (2028) NEM/NCP



Source: Landrum & Brown, 2024

Table C-20 Departure Flight Track Distribution – Future (2028) NEM/NCP

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
18L	18LDC4A-0	5.2%	5.2%	5.2%	5.2%	0.0%	0.0%
	18LDC4A-1	3.0%	3.0%	3.0%	3.0%	0.0%	0.0%
	18LDC4A-2	3.0%	3.0%	3.0%	3.0%	0.0%	0.0%
	18LDC4A-3	1.9%	1.9%	1.9%	1.9%	0.0%	0.0%
	18LDC4A-4	1.9%	1.9%	1.9%	1.9%	0.0%	0.0%
	18LDC4B-0	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	18LDC4B-1	3.0%	3.0%	3.0%	3.0%	0.0%	0.0%
	18LDC4B-2	3.0%	3.0%	3.0%	3.0%	0.0%	0.0%
	18LDC4B-3	1.5%	1.5%	1.5%	1.5%	0.0%	0.0%
	18LDC4B-4	1.5%	1.5%	1.5%	1.5%	0.0%	0.0%
	18LDC4B-5	0.8%	0.8%	0.8%	0.8%	0.0%	0.0%
	18LDC4B-6	0.8%	0.8%	0.8%	0.8%	0.0%	0.0%
	18LDC4B-7	0.4%	0.4%	0.4%	0.4%	0.0%	0.0%
	18LDC4B-8	0.4%	0.4%	0.4%	0.4%	0.0%	0.0%
	18LDC4C-0	5.3%	5.3%	5.3%	5.3%	0.0%	0.0%
	18LDC4C-1	3.0%	3.0%	3.0%	3.0%	0.0%	0.0%
	18LDC4C-2	3.0%	3.0%	3.0%	3.0%	0.0%	0.0%
	18LDC4C-3	1.9%	1.9%	1.9%	1.9%	0.0%	0.0%
	18LDC4C-4	1.9%	1.9%	1.9%	1.9%	0.0%	0.0%
	18LDC4D-0	7.1%	7.1%	7.1%	7.1%	0.0%	0.0%
	18LDC4D-1	4.1%	4.1%	4.1%	4.1%	0.0%	0.0%
	18LDC4D-2	4.1%	4.1%	4.1%	4.1%	0.0%	0.0%
	18LDC4D-3	2.5%	2.5%	2.5%	2.5%	0.0%	0.0%
	18LDC4D-4	2.5%	2.5%	2.5%	2.5%	0.0%	0.0%
	18LDC4E-0	6.9%	6.9%	6.9%	6.9%	0.0%	0.0%
	18LDC4E-1	4.0%	4.0%	4.0%	4.0%	0.0%	0.0%
	18LDC4E-2	4.0%	4.0%	4.0%	4.0%	0.0%	0.0%
	18LDC4E-3	2.5%	2.5%	2.5%	2.5%	0.0%	0.0%
	18LDC4E-4	2.5%	2.5%	2.5%	2.5%	0.0%	0.0%
	18LDC4F-0	5.2%	5.2%	5.2%	5.2%	0.0%	0.0%
	18LDC4F-1	3.0%	3.0%	3.0%	3.0%	0.0%	0.0%
	18LDC4F-2	3.0%	3.0%	3.0%	3.0%	0.0%	0.0%
	18LDC4F-3	1.9%	1.9%	1.9%	1.9%	0.0%	0.0%
	18LDC4F-4	1.9%	1.9%	1.9%	1.9%	0.0%	0.0%
	18LDE1	0.0%	0.0%	0.0%	0.0%	5.5%	33.3%
	18LDE2	0.0%	0.0%	0.0%	0.0%	47.1%	5.6%
	18LDE3	0.0%	0.0%	0.0%	0.0%	14.3%	0.0%
	18LDE4	0.0%	0.0%	0.0%	0.0%	4.9%	0.0%
	18LDE5	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%
	18LDN1	0.0%	0.0%	0.0%	0.0%	3.8%	0.0%
	18LDN2	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%
	18LDN3	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%
	18LDN4	0.0%	0.0%	0.0%	0.0%	2.4%	0.0%
	18LDN5	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
	18LDNW1	0.0%	0.0%	0.0%	0.0%	4.7%	0.0%
	18LDS1	0.0%	0.0%	0.0%	0.0%	5.6%	27.8%
	18LDW1	0.0%	0.0%	0.0%	0.0%	2.1%	33.3%

Table C-20 Departure Flight Track Distribution – Future (2028) NEM/NCP *(Continued)*

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
18L *(continued)*	18LDW2	0.0%	0.0%	0.0%	0.0%	3.9%	0.0%
	18LDW3	0.0%	0.0%	0.0%	0.0%	1.7%	0.0%
18L Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
18C	18CDC4A-0	1.8%	1.7%	1.8%	1.7%	0.0%	0.0%
	18CDC4A-1	1.0%	1.0%	1.0%	1.0%	0.0%	0.0%
	18CDC4A-2	1.0%	1.0%	1.0%	1.0%	0.0%	0.0%
	18CDC4A-3	0.6%	0.6%	0.6%	0.6%	0.0%	0.0%
	18CDC4A-4	0.6%	0.6%	0.6%	0.6%	0.0%	0.0%
	18CDC4B-0	6.7%	6.7%	6.7%	6.7%	0.0%	0.0%
	18CDC4B-1	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	18CDC4B-2	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	18CDC4B-3	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	18CDC4B-4	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	18CDC4C-0	7.6%	7.6%	7.6%	7.6%	0.0%	0.0%
	18CDC4C-1	4.4%	4.4%	4.4%	4.4%	0.0%	0.0%
	18CDC4C-2	4.4%	4.4%	4.4%	4.4%	0.0%	0.0%
	18CDC4C-3	2.7%	2.7%	2.7%	2.7%	0.0%	0.0%
	18CDC4C-4	2.7%	2.7%	2.7%	2.7%	0.0%	0.0%
	18CDC4D-0	6.7%	6.7%	6.7%	6.7%	0.0%	0.0%
	18CDC4D-1	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	18CDC4D-2	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	18CDC4D-3	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	18CDC4D-4	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	18CDC4E-0	6.6%	6.6%	6.6%	6.6%	0.0%	0.0%
	18CDC4E-1	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	18CDC4E-2	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	18CDC4E-3	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	18CDC4E-4	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	18CDC4F-0	5.6%	5.6%	5.6%	5.6%	0.0%	0.0%
	18CDC4F-1	3.2%	3.2%	3.2%	3.2%	0.0%	0.0%
	18CDC4F-2	3.2%	3.2%	3.2%	3.2%	0.0%	0.0%
	18CDC4F-3	2.0%	2.0%	2.0%	2.0%	0.0%	0.0%
	18CDC4F-4	2.0%	2.0%	2.0%	2.0%	0.0%	0.0%
	18CDE1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	18CDE2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	18CDE3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	18CDN1	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%
	18CDN2	0.0%	0.0%	0.0%	0.0%	8.1%	0.0%
	18CDN3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	18CDNW1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	18CDNW2	0.0%	0.0%	0.0%	0.0%	14.8%	0.0%
	18CDS1	0.0%	0.0%	0.0%	0.0%	3.0%	6.4%
	18CDSW1	0.0%	0.0%	0.0%	0.0%	1.7%	3.3%
	18CDW1	0.0%	0.0%	0.0%	0.0%	71.9%	90.3%
18C Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table C-20 Departure Flight Track Distribution – Future (2028) NEM/NCP *(Continued)*

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
36C	36CDB2A-0	2.4%	2.5%	2.5%	2.5%	0.0%	0.0%
	36CDB2A-1	1.9%	2.0%	2.0%	2.0%	0.0%	0.0%
	36CDB2A-2	1.9%	2.0%	2.0%	2.0%	0.0%	0.0%
	36CDB2A-3	1.0%	1.0%	1.0%	1.0%	0.0%	0.0%
	36CDB2A-4	1.0%	1.0%	1.0%	1.0%	0.0%	0.0%
	36CDB2A-5	0.7%	0.7%	0.7%	0.8%	0.0%	0.0%
	36CDB2A-6	0.7%	0.7%	0.7%	0.8%	0.0%	0.0%
	36CDB2B-0	5.7%	5.9%	5.9%	5.9%	0.0%	0.0%
	36CDB2B-1	3.3%	3.4%	3.4%	3.4%	0.0%	0.0%
	36CDB2B-2	3.3%	3.4%	3.4%	3.4%	0.0%	0.0%
	36CDB2B-3	2.0%	2.1%	2.1%	2.1%	0.0%	0.0%
	36CDB2B-4	2.0%	2.1%	2.1%	2.1%	0.0%	0.0%
	36CDB2C-0	6.1%	6.3%	6.3%	6.3%	0.0%	0.0%
	36CDB2C-1	3.5%	3.6%	3.6%	3.6%	0.0%	0.0%
	36CDB2C-2	3.5%	3.6%	3.6%	3.6%	0.0%	0.0%
	36CDB2C-3	2.2%	2.2%	2.2%	2.2%	0.0%	0.0%
	36CDB2C-4	2.2%	2.2%	2.2%	2.2%	0.0%	0.0%
	36CDB2D-0	6.4%	6.6%	6.6%	6.6%	0.0%	0.0%
	36CDB2D-1	3.7%	3.8%	3.8%	3.8%	0.0%	0.0%
	36CDB2D-2	3.7%	3.8%	3.8%	3.8%	0.0%	0.0%
	36CDB2D-3	2.3%	2.4%	2.4%	2.4%	0.0%	0.0%
	36CDB2D-4	2.3%	2.4%	2.4%	2.4%	0.0%	0.0%
	36CDB2E-0	6.7%	6.9%	6.9%	6.9%	0.0%	0.0%
	36CDB2E-1	3.8%	4.0%	4.0%	4.0%	0.0%	0.0%
	36CDB2E-2	3.8%	4.0%	4.0%	4.0%	0.0%	0.0%
	36CDB2E-3	2.4%	2.5%	2.5%	2.5%	0.0%	0.0%
	36CDB2E-4	2.4%	2.5%	2.5%	2.5%	0.0%	0.0%
	36CDB2F-0	5.6%	5.8%	5.8%	5.8%	0.0%	0.0%
	36CDB2F-1	3.2%	3.3%	3.3%	3.3%	0.0%	0.0%
	36CDB2F-2	3.2%	3.3%	3.3%	3.3%	0.0%	0.0%
	36CDB2F-3	2.0%	2.1%	2.1%	2.1%	0.0%	0.0%
	36CDB2F-4	2.0%	2.1%	2.1%	2.1%	0.0%	0.0%
	36CDE1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	36CDE2	3.0%	0.0%	0.0%	0.0%	1.3%	0.0%
	36CDN1	0.0%	0.0%	0.0%	0.0%	23.9%	0.0%
	36CDNE1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	36CDNW1	0.0%	0.0%	0.0%	0.0%	27.6%	0.0%
	36CDS1	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
	36CDS2	0.0%	0.0%	0.0%	0.0%	11.0%	0.0%
	36CDS3	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
	36CDW1	0.0%	0.0%	0.0%	0.0%	3.6%	66.7%
	36CDW2	0.0%	0.0%	0.0%	0.0%	32.4%	33.3%
	36CDW3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
36C Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table C-20 Departure Flight Track Distribution – Future (2028) NEM/NCP *(Continued)*

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
36R	36RDB2A-0	5.7%	5.7%	5.7%	5.7%	0.0%	0.0%
	36RDB2A-1	3.3%	3.3%	3.3%	3.3%	0.0%	0.0%
	36RDB2A-2	3.3%	3.3%	3.3%	3.3%	0.0%	0.0%
	36RDB2A-3	2.0%	2.0%	2.0%	2.1%	0.0%	0.0%
	36RDB2A-4	2.0%	2.0%	2.0%	2.1%	0.0%	0.0%
	36RDB2B-0	4.0%	4.0%	4.0%	4.0%	0.0%	0.0%
	36RDB2B-1	3.2%	3.2%	3.2%	3.2%	0.0%	0.0%
	36RDB2B-2	3.2%	3.2%	3.2%	3.2%	0.0%	0.0%
	36RDB2B-3	1.6%	1.6%	1.6%	1.6%	0.0%	0.0%
	36RDB2B-4	1.6%	1.6%	1.6%	1.6%	0.0%	0.0%
	36RDB2B-5	0.8%	0.8%	0.8%	0.8%	0.0%	0.0%
	36RDB2B-6	0.8%	0.8%	0.8%	0.8%	0.0%	0.0%
	36RDB2B-7	0.4%	0.4%	0.4%	0.4%	0.0%	0.0%
	36RDB2B-8	0.4%	0.4%	0.4%	0.4%	0.0%	0.0%
	36RDB2C-0	6.5%	6.5%	6.5%	6.5%	0.0%	0.0%
	36RDB2C-1	3.7%	3.7%	3.7%	3.7%	0.0%	0.0%
	36RDB2C-2	3.7%	3.7%	3.7%	3.7%	0.0%	0.0%
	36RDB2C-3	2.3%	2.3%	2.3%	2.3%	0.0%	0.0%
	36RDB2C-4	2.3%	2.3%	2.3%	2.3%	0.0%	0.0%
	36RDB2D-0	6.7%	6.7%	6.7%	6.7%	0.0%	0.0%
	36RDB2D-1	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	36RDB2D-2	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	36RDB2D-3	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	36RDB2D-4	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	36RDB2E-0	4.9%	4.9%	4.9%	4.9%	0.0%	0.0%
	36RDB2E-1	2.8%	2.8%	2.8%	2.8%	0.0%	0.0%
	36RDB2E-2	2.8%	2.8%	2.8%	2.8%	0.0%	0.0%
	36RDB2E-3	1.8%	1.8%	1.8%	1.8%	0.0%	0.0%
	36RDB2E-4	1.8%	1.8%	1.8%	1.8%	0.0%	0.0%
	36RDB2F-0	5.6%	5.6%	5.6%	5.6%	0.0%	0.0%
	36RDB2F-1	3.2%	3.2%	3.2%	3.2%	0.0%	0.0%
	36RDB2F-2	3.2%	3.2%	3.2%	3.2%	0.0%	0.0%
	36RDB2F-3	2.0%	2.0%	2.0%	2.0%	0.0%	0.0%
	36RDB2F-4	2.0%	2.0%	2.0%	2.0%	0.0%	0.0%
	36RDE1	0.0%	0.0%	0.0%	0.0%	9.0%	20.0%
	36RDE2	0.0%	0.0%	0.0%	0.0%	14.1%	40.0%
	36RDE3	0.0%	0.0%	0.0%	0.0%	6.9%	0.0%
	36RDN1	0.0%	0.0%	0.0%	0.0%	8.7%	0.0%
	36RDN2	0.0%	0.0%	0.0%	0.0%	6.4%	0.0%
	36RDN3	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%
	36RDNE1	0.0%	0.0%	0.0%	0.0%	0.7%	0.0%
	36RDNE2	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%
	36RDNE3	0.0%	0.0%	0.0%	0.0%	2.4%	0.0%
	36RDNW1	0.0%	0.0%	0.0%	0.0%	13.7%	0.0%
	36RDS1	0.0%	0.0%	0.0%	0.0%	6.9%	40.0%
	36RDSE1	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%
	36RDSE2	0.0%	0.0%	0.0%	0.0%	7.5%	0.0%

Table C-20 Departure Flight Track Distribution – Future (2028) NEM/NCP *(Continued)*

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
36R *(continued)*	36RDSE2	0.0%	0.0%	0.0%	0.0%	7.5%	0.0%
	36RDSW1	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%
	36RDSW2	0.0%	0.0%	0.0%	0.0%	3.4%	0.0%
	36RDSW3	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%
	36RDW1	0.0%	0.0%	0.0%	0.0%	4.3%	0.0%
	36RDW2	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%
36R Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
01	01DB2A-0	2.5%	2.5%	2.5%	2.5%	0.0%	0.0%
	01DB2A-1	2.0%	2.0%	2.0%	2.0%	0.0%	0.0%
	01DB2A-2	2.0%	2.0%	2.0%	2.0%	0.0%	0.0%
	01DB2A-3	1.0%	1.0%	1.0%	1.0%	0.0%	0.0%
	01DB2A-4	1.0%	1.0%	1.0%	1.0%	0.0%	0.0%
	01DB2A-5	0.7%	0.8%	0.7%	0.7%	0.0%	0.0%
	01DB2A-6	0.7%	0.8%	0.7%	0.7%	0.0%	0.0%
	01DB2B-0	5.9%	5.9%	5.9%	5.9%	0.0%	0.0%
	01DB2B-1	3.4%	3.4%	3.4%	3.4%	0.0%	0.0%
	01DB2B-2	3.4%	3.4%	3.4%	3.4%	0.0%	0.0%
	01DB2B-3	2.1%	2.1%	2.1%	2.1%	0.0%	0.0%
	01DB2B-4	2.1%	2.1%	2.1%	2.1%	0.0%	0.0%
	01DB2C-0	6.3%	6.3%	6.3%	6.3%	0.0%	0.0%
	01DB2C-1	3.6%	3.6%	3.6%	3.6%	0.0%	0.0%
	01DB2C-2	3.6%	3.6%	3.6%	3.6%	0.0%	0.0%
	01DB2C-3	2.2%	2.2%	2.2%	2.2%	0.0%	0.0%
	01DB2C-4	2.2%	2.2%	2.2%	2.2%	0.0%	0.0%
	01DB2D-0	6.6%	6.6%	6.6%	6.6%	0.0%	0.0%
	01DB2D-1	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	01DB2D-2	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	01DB2D-3	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	01DB2D-4	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	01DB2E-0	6.9%	6.9%	6.9%	6.9%	0.0%	0.0%
	01DB2E-1	4.0%	4.0%	4.0%	4.0%	0.0%	0.0%
	01DB2E-2	4.0%	4.0%	4.0%	4.0%	0.0%	0.0%
	01DB2E-3	2.5%	2.5%	2.5%	2.5%	0.0%	0.0%
	01DB2E-4	2.5%	2.5%	2.5%	2.5%	0.0%	0.0%
	01DB2F-0	5.8%	5.8%	5.8%	5.8%	0.0%	0.0%
	01DB2F-1	3.3%	3.3%	3.3%	3.3%	0.0%	0.0%
	01DB2F-2	3.3%	3.3%	3.3%	3.3%	0.0%	0.0%
	01DB2F-3	2.1%	2.1%	2.1%	2.1%	0.0%	0.0%
	01DB2F-4	2.1%	2.1%	2.1%	2.1%	0.0%	0.0%
	01DE1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	01DE2	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%
	01DN1	0.0%	0.0%	0.0%	0.0%	23.9%	0.0%
	01DNE1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	01DNW1	0.0%	0.0%	0.0%	0.0%	27.6%	0.0%
	01DS1	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
	01DS2	0.0%	0.0%	0.0%	0.0%	11.0%	0.0%
	01DS3	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%

Table C-20 Departure Flight Track Distribution – Future (2028) NEM/NCP *(Continued)*

Runway End	Track ID	Heavy Passenger Jet	Cargo Jet	Large Passenger Jet	Regional Jet	Prop Aircraft	Military
01 *(Continued)*	01DW1	0.0%	0.0%	0.0%	0.0%	3.6%	0.0%
	01DW2	0.0%	0.0%	0.0%	0.0%	32.4%	0.0%
	01DW3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
01 Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	0.0%
19	19DC4A-0	1.7%	1.8%	1.7%	1.8%	0.0%	0.0%
	19DC4A-1	1.0%	1.0%	1.0%	1.0%	0.0%	0.0%
	19DC4A-2	1.0%	1.0%	1.0%	1.0%	0.0%	0.0%
	19DC4A-3	0.6%	0.6%	0.6%	0.6%	0.0%	0.0%
	19DC4A-4	0.6%	0.6%	0.6%	0.6%	0.0%	0.0%
	19DC4B-0	6.7%	6.7%	6.7%	6.7%	0.0%	0.0%
	19DC4B-1	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	19DC4B-2	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	19DC4B-3	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	19DC4B-4	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	19DC4C-0	7.6%	7.6%	7.6%	7.6%	0.0%	0.0%
	19DC4C-1	4.4%	4.4%	4.4%	4.4%	0.0%	0.0%
	19DC4C-2	4.4%	4.4%	4.4%	4.4%	0.0%	0.0%
	19DC4C-3	2.7%	2.7%	2.7%	2.7%	0.0%	0.0%
	19DC4C-4	2.7%	2.7%	2.7%	2.7%	0.0%	0.0%
	19DC4D-0	6.7%	6.7%	6.7%	6.7%	0.0%	0.0%
	19DC4D-1	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	19DC4D-2	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	19DC4D-3	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	19DC4D-4	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	19DC4E-0	6.6%	6.6%	6.6%	6.6%	0.0%	0.0%
	19DC4E-1	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	19DC4E-2	3.8%	3.8%	3.8%	3.8%	0.0%	0.0%
	19DC4E-3	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	19DC4E-4	2.4%	2.4%	2.4%	2.4%	0.0%	0.0%
	19DC4F-0	5.6%	5.6%	5.6%	5.6%	0.0%	0.0%
	19DC4F-1	3.2%	3.2%	3.2%	3.2%	0.0%	0.0%
	19DC4F-2	3.2%	3.2%	3.2%	3.2%	0.0%	0.0%
	19DC4F-3	2.0%	2.0%	2.0%	2.0%	0.0%	0.0%
	19DC4F-4	2.0%	2.0%	2.0%	2.0%	0.0%	0.0%
	19DE1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	19DE2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	19DE3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	19DN1	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%
	19DN2	0.0%	0.0%	0.0%	0.0%	8.1%	0.0%
	19DN3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	19DNW1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	19DNW2	0.0%	0.0%	0.0%	0.0%	14.8%	0.0%
	19DS1	0.0%	0.0%	0.0%	0.0%	3.0%	0.0%
	19DSW1	0.0%	0.0%	0.0%	0.0%	1.7%	0.0%
	19DW1	0.0%	0.0%	0.0%	0.0%	71.9%	0.0%
19 Subtotal		100.0%	100.0%	100.0%	100.0%	100.0%	0.0%

Note: Totals may not equal sum due to rounding.
Source: Landrum & Brown, 2024